PETROLEUM PROCESSING

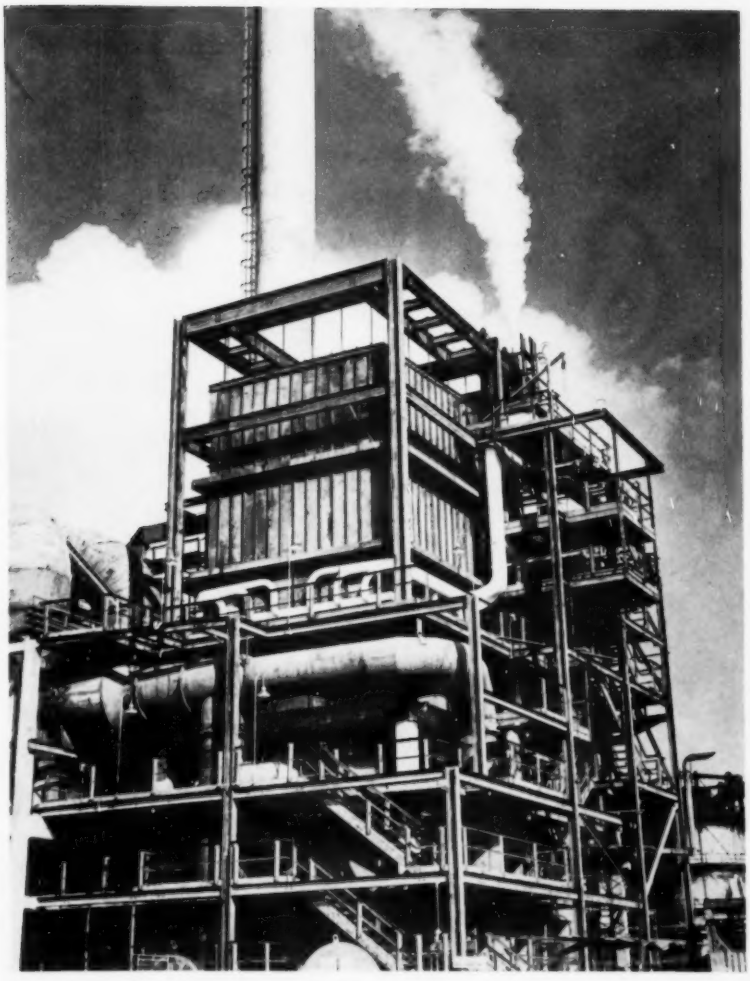
including Petrochemical Processing Section

MARCH 1954

Clean with Chemicals?
If you do, here are three 'musts,' and eight helpful case studies — p. 359

Large Electric Motors
Their selection, application, protection, and operation in today's refinery — p. 367

Petrochemical Storage
How one independent oil terminal is helping Shell Chemical Co. handle its products — p. 381



An Overlooked Heat Source?
This boiler burns cracking unit flue gas — p. 352

A McGRAW-HILL PUBLICATION

Sunset AT 3-BAR RANCH

Day after day through the years gas produced from oil wells on the 3-Bar Ranch in Andrews County, West Texas, will be gathered, compressed, processed, and reinjected into the producing formation — resulting in the production of many hundreds of thousands of barrels of otherwise unrecoverable crude oil, the extraction of millions of barrels of liquid hydrocarbons from the gas, and the availability for markets in future years of a large dry gas supply.

Hudson designed and constructed the plant in collaboration with Stanolind Oil and Gas Company. Stanolind operates the plant and shares in its ownership with Humble Oil and Refining Company, Champlin Refining Company, and the Superior Oil Company.

The facilities are designed to compress casinghead gas to a reinjection pressure of 2,700 pounds per square inch, and to recover from the gas heavier hydrocarbons which are fractionated into liquid products.

Designers and Constructors of Oil and Gas Processing Plants

HUDSON
ENGINEERING CORPORATION

FAIRVIEW STATION • HOUSTON, TEXAS

TV in automobiles?

There are mighty few cars equipped with TV sets. In fact, in some states it's illegal for safety reasons to put a TV set in the front compartment.

But Ethyl has discovered how to bring TV commercials selling your best gasoline, right into the car. That is to show these commercials in drive-in theatres. Judging from results, it's an excellent way to sell petroleum products.

During the past three summers, we used more than 500 drive-in theatres to supplement the coverage of our TV shows. Our minute movies reached an estimated weekly audience of 3,350,000 in 1953. But more important than coverage figures was the strength of the impression left with car owners.

(Continued on next page)

ETHYL
ANTIKNOCK COMPOUND
ETHYL CORPORATION

Printed in U. S. A.

TV in automobiles?

(Continued from preceding page)

We checked with service-station operators within a reasonable driving range of individual theatres after the showing of our films. Again and again we were told premium sales had gone up and that many people mentioned having seen the Ethyl films.

In fact, these films proved so successful in influencing motorists outside the TV areas that we are including selected drive-in theatres in our 1954 advertising plans to help sell more "Ethyl" gasoline. We wondered if perhaps some of our friends in the merchandising and advertising end of the oil business might not be interested in hearing of this relatively new — but proved — way of selling petroleum products.

Ethyl's use of drive-in movies to help sell your best gasoline is another service we are happy to perform for our friends in the oil industry.

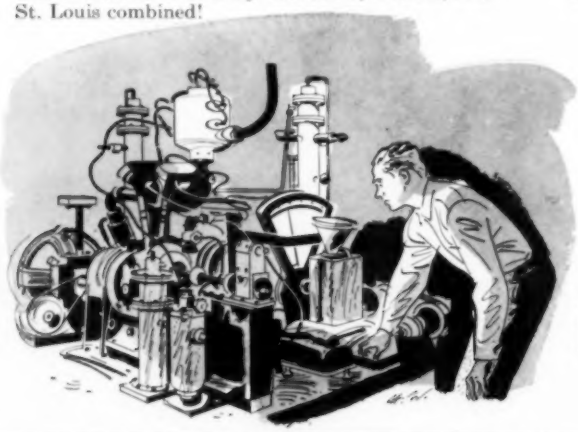
ETHYL CORPORATION

NEW YORK 17, NEW YORK

WORTH NOTING

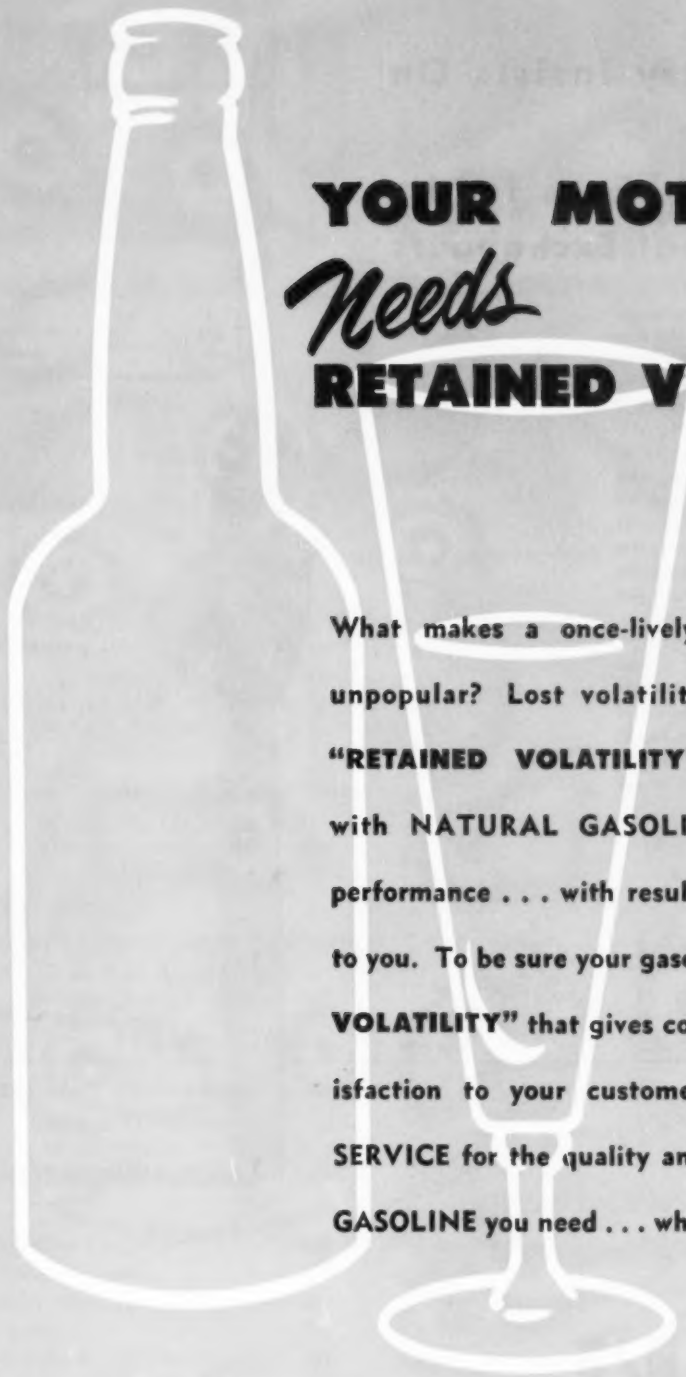
3,000 gallons of sea water must be treated to obtain just one pound of bromine for "Ethyl" antiknock fluid. And to keep Ethyl supplied with this chemical, Ethyl-Dow Corporation each day processes as much water as is used by Cleveland, Detroit, and St. Louis combined!

1953 was the 20th year of publication of the Ethyl "Brief Passenger Car Data" booklets . . . handy pocket volumes which give pertinent engine specifications on all late-model automobiles.



Over 250,000 test hours on aviation problems have been logged at the Ethyl Research Laboratories for the Armed Forces.

Ethyl Service is backed by 31 years of antiknock experience



YOUR MOTOR FUEL *Needs* RETAINED VOLATILITY *too!*

What makes a once-lively drink stale, flat and unpopular? Lost volatility. Motor fuel without **"RETAINED VOLATILITY"** gained by blending with NATURAL GASOLINE soon goes flat in performance . . . with results definitely unprofitable to you. To be sure your gasoline has the **"RETAINED VOLATILITY"** that gives consistent and uniform satisfaction to your customers, rely on WARREN'S SERVICE for the quality and quantity of NATURAL GASOLINE you need . . . where and when you want it.

WARREN

PETROLEUM CORPORATION

TULSA, OKLAHOMA • Cable Addresses: STAVOLENE, WARREN

EXPORT TERMINALS: CORPUS CHRISTI, PORT ARTHUR, BAYTOWN
TEXAS CITY AND WARRENGAS, HOUSTON, TEXAS

The Petroleum Industry Insists On

HARTZELL Fans for Its Cooling Towers and Heat Exchangers

Hartzite plastic for cooling tower and heat exchanger fan blades was developed especially to meet the rugged requirements of the petroleum industry. After more than ten years of service in the most punishing installations, Hartzite blades have proved themselves beyond all expectations.

What evidence is there of the superiority of Hartzell cooling tower and heat exchanger fans with Hartzite blades? Nearly every Hartzell fan installed since the introduction of the Hartzite blade in 1941 is still in service. And in nearly every case, where one Hartzell fan has been installed on a battery of cooling towers or heat exchangers, more Hartzells have followed as other blades needed replacement.

Fabric-base Hartzite absorbs vibration. Its strength is many times that necessary to withstand normal stresses. Its unusual resistance to corrosion and abrasion is constant throughout the blade. Hubs are of welded steel with an extremely high safety factor.

These are the reasons why Hartzell has become "the" cooling tower and heat exchanger fan in the petroleum industry.

For the complete story, send for Bulletin 1503.

HARTZELL

propeller fan co.

Div. of Castle Hills Corp.

Name _____

Company _____

Street & Number _____

City & State _____

If student, check here for special information ☐

Dept. K

PIQUA, OHIO

PROPELLER-TYPE FANS • BLOWERS
ROOF VENTILATORS • UNIT HEATERS

ENGINEERING OFFICES IN PRINCIPAL CITIES

(To obtain more data on advertised products see page 424)

PETROLEUM PROCESSING

Covering petroleum and petrochemical research and the design, construction, management, operation and maintenance of plants processing hydrocarbon materials into fuels lubricants and chemicals.

March, 1954
Vol. 9, No. 3

Contents

FEATURE ARTICLES

Refining Section

And Now—A 'Big Union' in Oil **349**

How soon, how it happened, and what it means to the petroleum processing industries

Cracking Unit a Source of Heat? **352**

Use waste heat to make steam by burning and then superheating flue gas, by O. F. Campbell and N. E. Pennels

Three "Musts" in Chemical Cleaning **359**

A scientific approach for efficient cleaning where chemicals can do the job, by D. P. Thornton, Jr.

8 Jobs Done by Chemical Cleaning **361**

Some typical applications in refinery, natural gasoline and petrochemical plants

Canada's Biggest Refinery Project **364**

Remodeling of Imperial Oil refinery will boost capacity to 41,625 b/d

Large Motors in the Refinery **367**

Their selection and application, plus some advice on common operating problems, by Carl Lathrop and Edward Winsor

Detecting Arsenic in Oil or Catalyst **374**

A method developed by Sinclair involving conversion to arsine, by Raymond Jay and Lester Dickson

Petrochemical Section

Let Someone Else Handle Your Storage Problems **381**

How a petroleum terminal expanded to store Shell petrochemicals, by Frank Breese

Hydrogen Cyanide **384**

The manufacture and uses of a major petrochemical, by Peter Sherwood

New Research Center for Dow **390**

Accent is on petrochemical studies at Dow's new Southwest facilities

DEPARTMENTS

Publisher's Page	297	Plant Practices	393	Meetings	419
What's Happening	299	Lab Practices	397	Information Offered	422
Tomorrow	303	Patents	401	Advertisers' Index	424
Trends	309	Suppliers	409	What's New	425
New Words	389	Personals	413	Editorials	448

A McGRAW-HILL PUBLICATION

Petroleum Processing is published monthly by McGraw-Hill Publishing Co., Inc. James H. McGraw (1860-1948) founder.

Publication Office: 1309 Noble St., Philadelphia 23, Penna.

Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 West 42nd St., New York 36, N. Y. Donald C. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.

Subscriptions: Address correspondence to **Petroleum Processing**, Subscription Service, 1309 Noble St., Philadelphia 23, Penna., or 330 West 42nd St., New York 36, N. Y. Subscription rates: domestic single copies 35c. United States and possessions, $2 per year, $3 for two years, $4 for three years; Canada, $3 per year, $4 per two years, $5 for three years; Latin America, $8 per year, $12 for two years, $16 for three years; all other countries $10 per year, $16 for two years, $20 for three years.

Published prior to Sept. 1946 as the Technical Section of National Petroleum News, devoted to Refinery Management and Petroleum Chemical Technology, and including International Petroleum Technology. Application pending as second class matter at Philadelphia, Penna. Printed in U.S.A. Copyright 1954 by McGraw-Hill Publishing Co., Inc. All rights reserved.

Paint, Varnish and Shellac

Motor Oil and Gasoline (Additives)

Synthetic Rubber, Synthetic Yarns

You get proved results when you use ENJAY

34 successful years of leadership in serving industry

for a complete line of high quality petroleum chemicals

PETROLEUM

PARANOX
PARATONE
PARAFLOW
PARAPOID
PARADYNE
PARATAC
PETROHOL
Methyl Ethyl Ketone
Dewaxing Aid
Ethyl Ether
Isopropyl Ether
Reference Fuels

SURFACE COATING

PETROHOL 91
PETROHOL 95
PETROHOL 99
JAYSOL
Secondary Butyl Alcohol
Secondary Butyl Acetate
Isopropyl Acetate
Acetone
Methyl Ethyl Ketone
Ethyl Ether
Isopropyl Ether
Dicyclopentadiene
Naphthenic Acids
Iso-Octyl Alcohol
Decyl Alcohol
Denatured Ethyl Alcohol

CHEMICAL

PETROHOL 91
PETROHOL 95
PETROHOL 99
JAYSOL
Iso-Octyl Alcohol
Decyl Alcohol
Denatured Ethyl Alcohol
Tridecyl Alcohol
Dicyclopentadiene
Isoprene
Butadiene
Ethyl Ether
Isopropyl Ether
Tetrapropylene
Tripropylene
Aromatic Tars
Benzene
Acetone
Methyl Ethyl Ketone

Depend on the Enjay Company for a complete line of petroleum chemicals backed by research, experience, know-how and proved results. Enjay is a recognized leader in developing and marketing uniform, high quality chemicals for the petroleum, surface coating and chemical industries.

Not only does Enjay supply a constantly growing list of petroleum chemicals to an increasing number of industries – Enjay is also ready to assist in developing new or improved products through chemistry. For proved results, make it *your* business to specify Enjay.

ENJAY COMPANY, INC. • 15 West 51st Street, New York 19, N. Y.

(To obtain more data on advertised products see page 424)

PETROLEUM PROCESSING

Publisher's Page

A McGRAW-HILL PUBLICATION

Editorial & Business Offices
330 West 42nd St., New York 36, N.Y.

Harry L. Waddell, *Publisher*
Warren C. Platt, *Consulting Editor*

Editorial Staff

William F. Bland, Editor
Virgil B. Guthrie, Associate Editor
William C. Uhl, Associate Editor—Equipment
William A. Caperell, Jr., Art Director
Stuart D. Boynton, Editorial Assistant
Jane L. Witzig, Editorial Assistant
D. P. Thornton, Jr., Southwestern Editor
810 First Nat'l. Bank Bldg., Houston 2
Frank Breese, West Coast Editor
1111 Wilshire Blvd., Los Angeles 17
Andrew R. Patla, Washington Editor
1188 Nat'l. Press Bldg., Washington 4
Peter J. Gaylor, Patent Reviewer

Business Staff

William J. Parkin, Advertising Sales Mgr.
K. W. McKinley, Research & Promotion Mgr.
Fred R. Emerson, Business Mgr.
John E. Thompson, Production Mgr.

Regional Sales Representatives

NEW YORK 36, N. Y.
P. S. Carberry, 330 West 42nd St.
PHILADELPHIA 3, PA.
C. J. Jefferis, 17th and Sansom Sts.
ATLANTA 3, GA.
R. H. Sidur, 801 Rhodes-Haverty Bldg.
CLEVELAND 15, OHIO
David G. Sawyer, 1510 Hanna Bldg.
CHICAGO 11, ILL.
R. D. Henriquez, 520 North Michigan Ave.
HOUSTON 2, TEXAS
George Reid, 810 First Nat'l Bank Bldg.
SAN FRANCISCO 4, CALIF.
Ralph Dorland, 68 Post St.
LOS ANGELES 17, CALIF.
Joseph Allen, 1111 Wilshire Blvd.

Have You Been "Converted" Yet?

FOR two days last month I sat in the English Room of the Peabody Hotel in Memphis, Tenn., and soaked up a liberal education on circulation. The occasion was a district meeting of the McGraw-Hill field circulation representatives—one of four such meetings held around the country each year.

As many of you readers are aware, PETROLEUM PROCESSING from its beginning in 1946 has been a free-distribution magazine—sent without charge to those of you in the petroleum processing industries who we thought would benefit from its editorial content.

Now, since we joined the McGraw-Hill family last April, it is being converted to a paid-subscription basis. McGraw-Hill believes strongly that the quality and service of any product should constantly be subjected to the test of having to be sold. Part of the selling job is done by field representatives. There are about 150 of them throughout the United States, and they work with a staff in New York which sells subscriptions by mail.

Since most of you will probably be called on by one of these field representatives sooner or later, I thought you might like to know a little bit about them. They are high-grade industrial salesmen. Their average age is 47½, and they've been in this field circulation business with McGraw-Hill on the average for eight years—a few as many as 25 years. Most are college graduates, and some have been in business for themselves at one time or another.

My role in the Memphis and similar meetings has been to help explain the inner workings of the petroleum processing industries and spell out the types of management and technical people (like yourself) who should be reading this magazine. These field representatives work under extremely strict regulations. They don't dare take your subscription to PETROLEUM PROCESSING unless you're in a specific part of the industry and have a position above a certain level.

Before those two days in Memphis were finished, I was being grateful for three things: (1) that McGraw-Hill hadn't had a petroleum magazine in competition with us before they acquired PETROLEUM PROCESSING, (2) that I now don't have to compete with PETROLEUM PROCESSING, and (3) that these field men are on my team.

And don't make the mistake of assuming that these field circulation representatives are a lot of "subscription agents working their way through college." They aren't—by a long shot.

William F. Bland

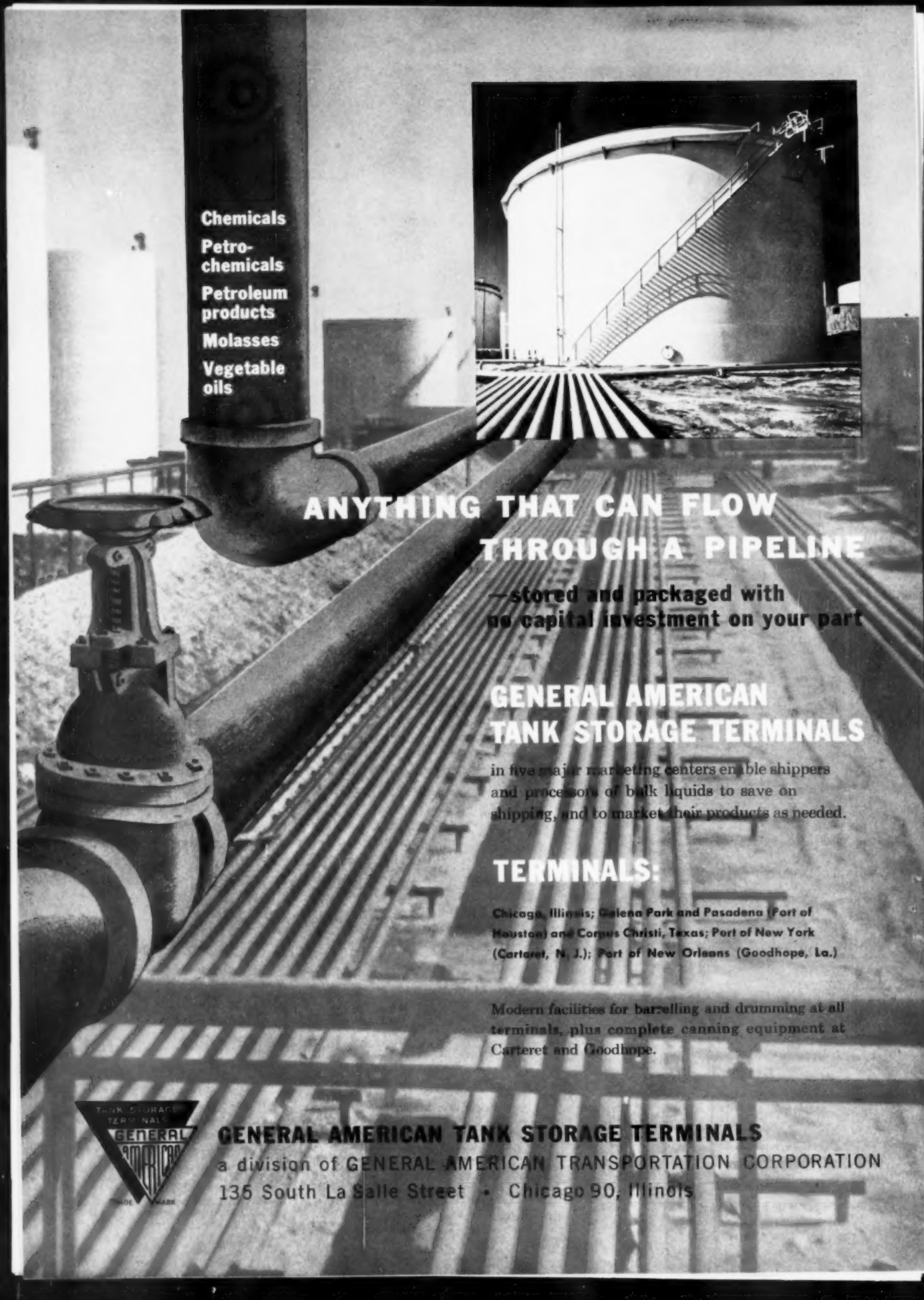
Editor

Other McGraw-Hill Petroleum Publications

National Petroleum News
The weekly oil marketing magazine, covering news, prices, transportation, storage, merchandising.

Platt's Oilgram News Service
A daily independent oil-news reporting service issued from New York, Chicago and Houston.

Platt's Oilgram Price Service
A daily independent oil-price reporting service issued from New York, Chicago and Houston.


Chemicals
Petro-chemicals
Petroleum products
Molasses
Vegetable oils
ANYTHING THAT CAN FLOW THROUGH A PIPELINE
—stored and packaged with no capital investment on your part
GENERAL AMERICAN TANK STORAGE TERMINALS
in five major marketing centers enable shippers and processors of bulk liquids to save on shipping, and to market their products as needed.
TERMINALS:
Chicago, Illinois; Galena Park and Pasadena (Port of Houston) and Corpus Christi, Texas; Port of New York (Carteret, N. J.); Port of New Orleans (Goodhope, La.)
Modern facilities for barrelling and drumming at all terminals, plus complete canning equipment at Carteret and Goodhope.
TANK STORAGE TERMINALS
GENERAL AMERICAN
GENERAL AMERICAN TANK STORAGE TERMINALS
a division of GENERAL AMERICAN TRANSPORTATION CORPORATION
135 South La Salle Street • Chicago 90, Illinois

What's Happening...

in Refinery Expansion

. . . **Basic U. S. refining capacity** of 1,668,000 b/d at an estimated cost of $1,524,758,000 has been approved for rapid tax write-off since the industry's expansion program started in the fall of 1950. Natural gasoline projects approved total 270,000 b/d at $300,939,000. Total of 35 petrochemical projects were approved at cost of $157,573,000. The program calls for total basic capacity by Jan. 1, 1955, of 8,750,000 b/d.

. . . **Gulf Oil Corp.** has awarded construction contract for new 29,000 b/sd. UOP Platforming unit for Pt. Arthur, Texas, refinery, to Fluor Corp. Work is scheduled for start this spring and completion is expected in a year. Unit is being installed to raise quality, rather than quantity, of high octane motor gasoline production, company said, and it may also be used to improve and expand aviation gasoline production.

. . . **Union Oil Co. of California** has acquired a site in San Luis Obispo county, Calif., for a new coking unit for preliminary processing of Santa Maria crude oil.

. . . **Westoil Terminals Co.** plans for expansion of San Pedro, Calif., refinery including catalytic cracking and polymerization. (WHAT'S HAPPENING, Nov., 1953, p. 1623.)

. . . **Esso Standard Oil Co.** has been granted a fast tax write-off for a $14,900,000 project at Bayway, to include a 60,000 b/d crude still and 21,500 b/d fuel oil processing unit, as well as utilities and auxiliaries.

. . . **The Texas Co.** will build a sulfuric acid alkylation plant at Westville, N. J., with 2000 b/d alkylate capacity. James P. O'Donnell is contractor for structural and piping design.

. . . **Crown Central Petroleum Co.** has made arrangements with Houdry Process Co. for a 5,000 b/d Houdriformer at Houston. Construction contract for the reformer and other facilities went to Blaw-Knox, with completion set for October.

. . . **Pan American Refining Corp.** has begun construction on a 21,000-b/d Ultraforming unit at its Texas City refinery. M. W. Kellogg Co. is contractor with project scheduled for completion Nov. 1.

. . . **Kerr-McGee Oil Industries, Inc.,** has started work on $4,500,000 expansion and improvement program at Wynnewood, Okla., to be completed by Nov. 10. Koch Engrg. Co. has contract for new crude unit to boost existing 9,000 b/d capacity to 15,000 b/d. Refinery Engrg. Co. will build a 6,000 b/d Fluid cracking unit and a cat poly unit under license agreements with Universal Oil Products Co., and also a gas concentration unit it designed. Fluor Corp. made the preliminary engineering studies.

. . . **Skelly Oil Co.** will install a 7500-b/d catalytic reformer at El Dorado, Kans. Design, engineering and construction will be done by the company. Licensing arrangements have been made with Universal Oil Products Co.

. . . **Prime Oil Co.,** division of Wood River Oil & Refining Co., will build a new 15,000 b/d refinery at Calumet City, Ill., to cost $10,000,000. Plant will operate on pipeline crude from the Southwest and Wyoming, but is adjacent to water, making Canadian crude an alternate source of supply.

. . . **Hi-Way Refineries, Ltd.,** has increased the crude capacity of its Saskatoon, Canada, refinery from 4000 to 6500 b/d, by converting a thermal cracking unit (two-coil) into a combined crude and visbreaker-vacuum unit. A 2600 b/d UOP Fluid catalytic cracking unit, gas concentration plant, and a poly unit were also installed.

in Petrochemicals

. . . **Gulf Oil Corp.** has awarded contract for the second ethylene unit at Pt. Arthur, Texas, refinery to Badger Process Div., Stone & Webster Engrg. Corp. Unit, with a capacity of 3 billion cu. ft./yr., will more than double existing production and represent an increase of about 10% in nation's production. It will use propane and other refinery gases as feed. Completion is anticipated in first quarter, 1955.

. . . **Sinclair Chemicals, Inc.,** is building a unit at Marcus Hook, Penna., to recover paraxylene from a catalytic reformer already under construction. Capacity will be 10,000,000 lb./yr., and product is to be supplied Hercules Powder Co. for use in making synthetic fiber. As part of aromatics expansion program, Sinclair will also make toluene, xylene solvents, and heavier aromatics.

. . . **Koppers Co., Inc.,** plans a large polyethylene plant, possible location Port Arthur, Texas, where it now has a new chemical plant. Company now produces polystyrene, the rigid plastic material; and adding the non-rigid polyethylene rounds out its line for the plastics industry.

. . . **Warren Petroleum Corp.** has awarded construction contract for new $2,000,000 petrochemical plant near Conroe, Texas, to O. L. Olsen Co., Houston, and completion is expected by July 1. Using a Warren-developed process, it will take raw material from Midland Gasoline Co. and is designed for annual output

Information on these pages is obtained through the nation-wide news coverage service of PLATT'S OILGRAM NEWS

of 2,500,000 lb. pentaerythritol, 4,000,000 lb. methyl alcohol, and 2,000,000 lb. acetaldehyde.

. . . **Glidden Co.,** Cleveland, is a newcomer to the petrochemical industry. A large paint manufacturer owning oil and mineral rights to substantial properties, the company is now researching to find petrochemical substitutes for natural oils in some of its products.

. . . **Commercial Solvents Corp.** will produce nitroparaffins, a new family of commercial petrochemicals, at a plant to be built at Sterlington, La. Its present nitroparaffins operation at Peoria, Ill., also will be enlarged. Company has doubled its methanol, ammonia, and nitric acid capacity to provide raw materials for the new products.

. . . **Union Oil Co. of California** is planning a new nitric acid and ammonium nitrate plant to be located adjacent the large ammonia plant now being built at Brea, Calif., by the Amoniaco Corp.

. . . **Columbian Carbon Co.** will build an oil process carbon black plant, with an ultimate capacity of 60,000,000 lb./yr., in St. Mary's Parish, Louisiana.

. . . **Surpass Petrochemicals, Ltd.,** of Canada, has purchased the Alox Corp., which operates a plant at Niagara Falls manufacturing rust preventives and engine oil additives, together with Canadian rights to the patented formulas. Surpass is equipping a plant at Scarborough for blending and producing petroleum derivatives.

. . . **Petroleum & Chemical Corp., Ltd.** (Australia) has been organized to build a high temperature cracking plant at Sydney, to make crude benzene, toluene, and xylenes.

in Markets and Prices

. . . **Normal winter trends ruled oil markets** in the first half of February. Distillate fuels were buoyant under the impetus of record demand, while a buyer's market continued for gasoline. Heavy fuels for the most part were steady, while lubricating oils were weak.

. . . **Inventories of kerosine and light fuel oils** were down by mid-February to the point where they approximated the year previous levels. As recently as the year end, stocks of these oils had been considered as excessive by many in the trade.

Prices were quick to reflect the sharp decline in inventories. At the Gulf, cargo lots were quoted 0.25¢ higher, at 9.5¢ for kerosine and 8.5¢ for No. 2 fuel. In the Midwest, distillates were up 0.125¢, with kerosine at 9.125¢ and No. 2 fuel 8.25¢, Group 3 basis. Eastern tank wagon prices rose 0.3¢/gal., regaining most of the ground lost earlier in the heating season.

. . . **Gasoline, on the other hand, was weak.** Inventories early in February hit an all-time high of close to 172 million bbl., at which point they were approximately 20 million bbl. above early February, 1953, level. Cargo prices were down at the Gulf—0.5¢ to 12.5¢/gal. for top-grade (95 oct.) premium, and 0.25¢, to 10.5¢ for 87-oct. regular. Group 3 prices were off 0.25¢, to 11.75¢ and 10.75¢ for premium and regular, respectively.

. . . **Volatile products also were weak.** Natural gasoline, grade 26-70, was down 0.5¢, to 5¢/gal., Group 3, and 4.5¢, Breckenridge. A move to boost LP-gas prices in the Mid-Continent petered out with some manufacturers, who upped their quotations for propane from 4¢ to 4.5¢, dropping back to the lower figure within a few days of their advances.

. . . **Heavy fuels eased somewhat** in the Mid-Continent, but were still a fairly bright spot in the general market picture. Cargo prices at the Gulf were firm at a low of $1.85/bbl.

Looking Ahead

. . . **Refinery product with the biggest volume growth** in coming months, will be jet fuels. Still a tiny mite compared with major products, output in 1953 was around 35,000,000 bbls., over 65% larger than in 1952. By comparison, aviation gasoline production last year was 85,000,000 bbls. These are Mines Bureau figures.

Impetus for the growth is the Air Force schedule of 20,000 jet planes by the end of 1955, while today we have 11,000. Makeup of total jet fuel supply in 1953 was close to JP-4 specifications: 70% gasoline, 20% kerosine, 10% distillate fuels. Trend is toward the use of more kerosine.

. . . **New developments in the smog situation:**

Combustion engineers for the automobile makers made a two-week's survey of the contribution of exhaust fumes to Los Angeles' nuisance. Oil men say refiners now expell only 212 tons of hydrocarbons daily into the atmosphere, while automobile exhausts supply 850 tons.

The Southern California Air Pollution Foundation, newly formed to coordinate scientific work on the problem, named Dr. Lauren B. Hitchcock, New York chemical engineer, president and managing director, at $50,000 a year.

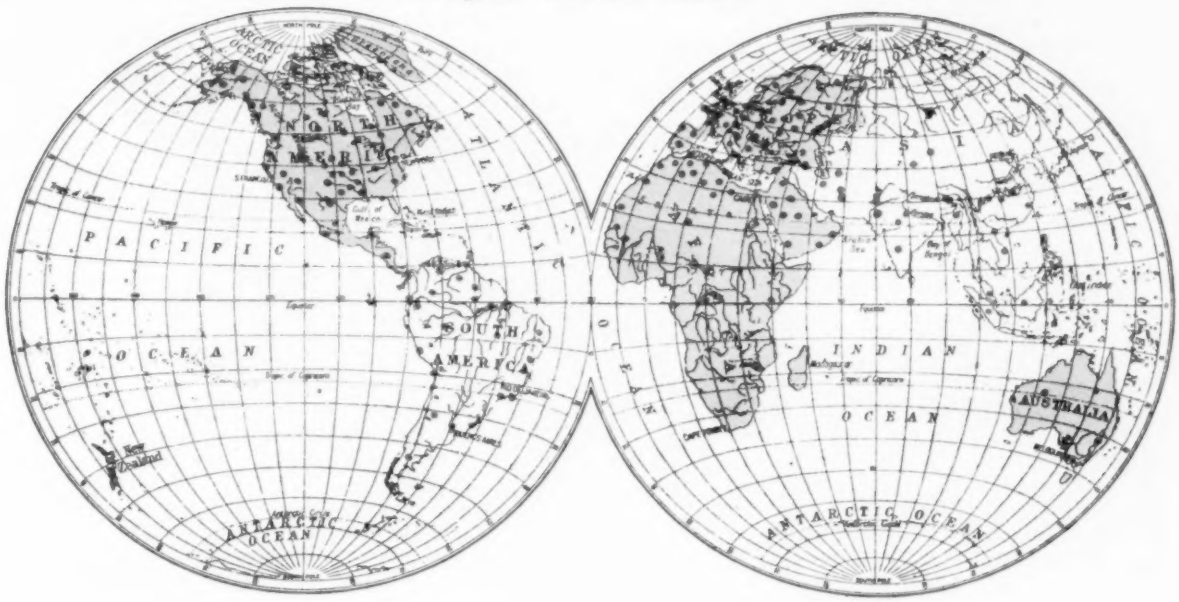
In San Francisco, the Department of Health is considering creating a Bay area air pollution control district. "Otherwise," said a bulletin, "we may have a problem similar to that in Los Angeles."

. . . **Compression ratios are up** 0.25 average for the '54 model cars. Average compression for 38 new models is 7.65 to 1; previous average 7.4. Highest is 8.7 in the Packard "Patrician," up 0.7. One Nash model and three Buicks are up to 8.5. Twelve new cars are 8:1 or above; and there's no change in compression rating in 15 models.

LUMMUS

designs, engineers and constructs petroleum and chemical plants

scope: world-wide



No petroleum or chemical area in the free world is more than a few hours flying time from a Lummus office.

From principal cities on five continents, Lummus staffs have designed, engineered and directed the construction of over 700 major plants and installations.

Think of Lummus when planning your next project — location anywhere.

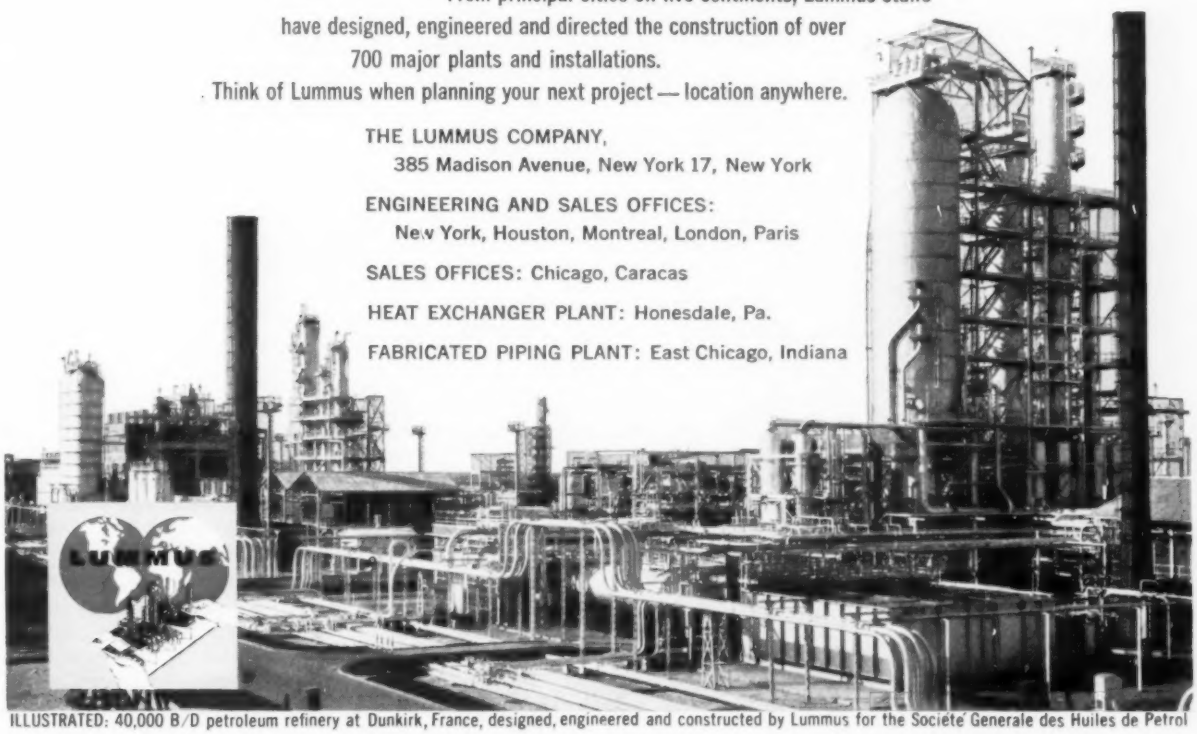
THE LUMMUS COMPANY,
385 Madison Avenue, New York 17, New York

ENGINEERING AND SALES OFFICES:
New York, Houston, Montreal, London, Paris

SALES OFFICES: Chicago, Caracas

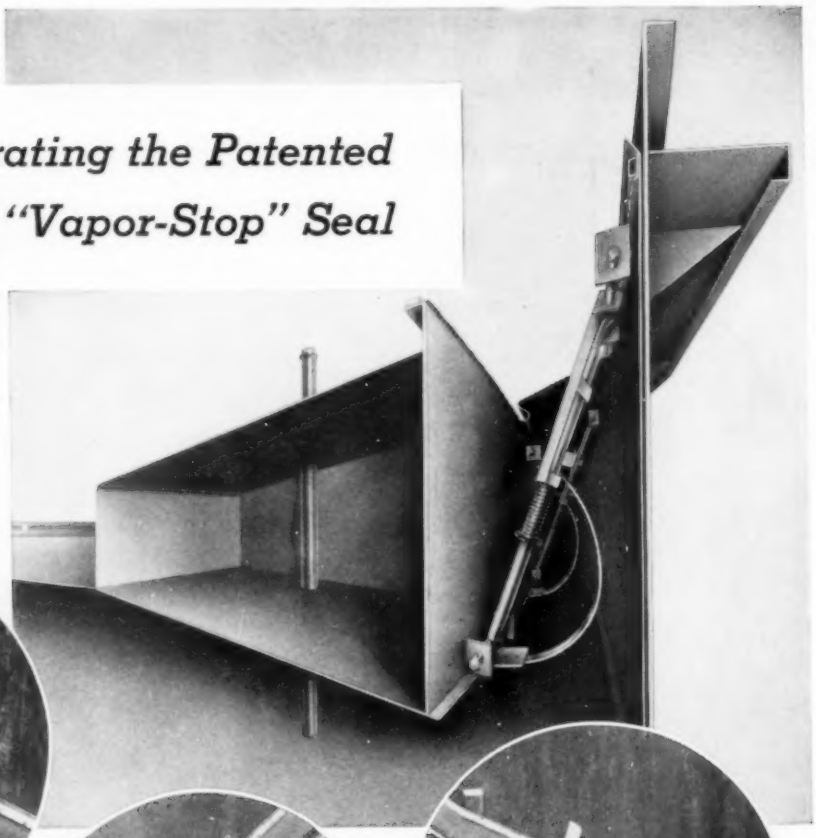
HEAT EXCHANGER PLANT: Honesdale, Pa.

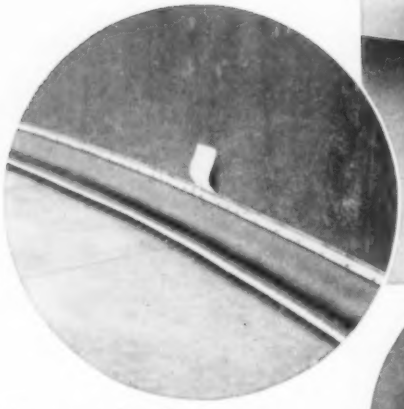
FABRICATED PIPING PLANT: East Chicago, Indiana



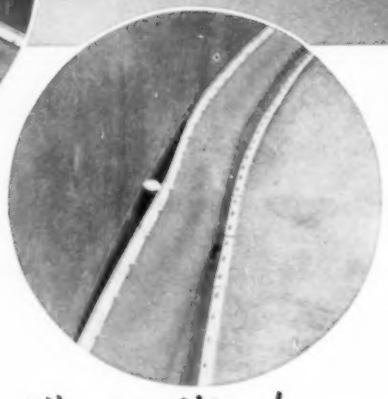
ILLUSTRATED: 40,000 B/D petroleum refinery at Dunkirk, France, designed, engineered and constructed by Lummus for the Société Generale des Huiles de Petrol

Demonstrating the Patented GRAVER *"Vapor-Stop" Seal*



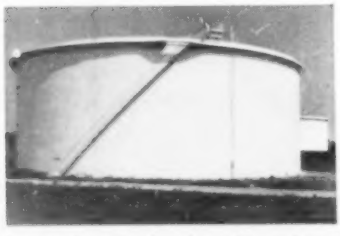


it's tight! As seen above, the Graver "Vapor-Stop" Seal provides a firm closure between the roof and tank shell—so tight that a piece of paper will not slip through.



it's sensitive! Despite its effective closure, the sealing mechanism is so sensitive it does not break the egg shown above, indicating the friction-free, long-lasting performance that the seal provides.

it's flexible! The seal is free to move over obstructions, yet continues to close the gap and prevent loss of vapors. It is successful on both converted tank shells and new construction.



The seal mechanism is an integral part of all Graver Floating Roof designs, including the Double-Deck Floating Roof tank and the Center-Weighted Pontoon and Pan-type Floating Roof tanks.

This patented seal is the key to the successful functioning of Graver Floating Roof tanks. Composed of two mechanisms—a weighted arcuate pusher and a spring-actuated hanger, it acts as a "Vapor-Stop," preventing loss of volatile vapors. The seal provides positive centering action for the roof. It also prevents the entrance of air and rain, and resists corrosion.

Simple and foolproof, it eliminates the need for multiple seals. The mechanisms are completely covered, and the fabric is asbestos coated with Neoprene, impervious to vapors. Graver's "Vapor-Stop" Seal is fire-resistant and Underwriters' Laboratories approved.

GRAVER

... a specific conservation design to fit every need.

GRAVER TANK & MFG. CO., INC.

East Chicago, Indiana

NEW YORK • CHICAGO • PHILADELPHIA • ATLANTA • DETROIT
CLEVELAND • PITTSBURGH • HOUSTON • CATASAUQUA, PA.
SAND SPRINGS, OKLA • CASPER, WYO. • ODESSA, TEXAS
LOS ANGELES • EDGE MOOR, DEL. • TULSA

Will the "Push-Button" Refinery Rob Peter to Pay Paul?

INSTRUMENT manufacturers and their customers are not so sure the day of the automatic factory is very far away, according to ideas expressed during the recent symposium on "Instrumentation for the Process Industries" held at Texas A & M College.

They reported, in fact, that a number of manufacturing operations, details of which are classified for security reasons, are almost wholly push-button affairs. Most of the processing, inspection, packaging and labeling in these plants is controlled through automation. This, they believe, will spread.

Frequently threading through discussions was the possibility of hitching automatic computers of one type or another directly to one or more sensing instruments, and the feasibility of allowing the results of the computation to directly control the process, or some part of it. The angle here is that the computer will use the instrument-gathered data, together with instructions and more data from its "memory," to reach an electronic-powered decision as to what should be done next. This decision then will be communicated to a control instrument.

For example, let's assume the sensing instrument is an analyzer set to detect certain impurities in the overhead of a fractionator, which also is equipped with conventional temperature, flow and pressure controls. With certain impurities the column temperature must be lowered; with others, increased.

The analyzer reports its results to a computing instrument. The computer makes the analysis calculations and then, in accordance with instructions in its "memory," decides first if product purity is or is not within acceptable limits and second, if unacceptable, its temperature should be decreased or increased and by how much (again drawing on "experience" impressed on its "memory").

A decision having been made and the magnitude of corrective action settled, the mechanical brain then moves the set point of the controller to the appropriate new position. It might achieve its decision statistically by ascertaining whether or not the detected variation is within the limits of probability or indicates a definite trend in an undesired direction.

An analytical instrument now is said to be in the early development stage whereby a process stream will be analyzed by its response to atomic radiation, the results being communicated to either the control panel or a controlling device; it could transmit them to an electronic brain also, although this was not mentioned as part of the set-up. Of course, it is not new to find spectrographs already in the plant but, in general, they are not being commonly used for direct process control.

Plant automation will not necessarily cut payrolls, however, especially where computers are involved, or the system is complex. Most of this equipment will require extensive and highly skilled maintenance in at least the present state of the art. Thus, even though the operator roster might be reduced as a consequence of automation, the maintenance staff will increase markedly. And there must still be some one around to push the right buttons. —D.P.T.

Long-Range Importance Seen for New Peacetime Atom Applications

OF the two most recent developments in civilian use of atomic energy—the new miniature battery using radioactive elements and the atomic-powered railroad locomotive—the battery has greater long term significance to energy-supplying industries, such as petroleum.

The difference between the two developments represents the same basic obstacle still confronting an immediate peacetime development of the atom as a serious competitor to other sources of energy. The locomotive, as now projected, converts atomic power into steam, which in turn drives a turbine to produce electrical energy for the electric motors. On the other hand, the battery produces electrical energy directly from atomic energy.

To mean very much to the oil man, the locomotive would have to compete with the Diesel. Arguments to indicate it can have been presented by former Atomic Energy Commission scientist, Dr. Lyle B. Borst, now professor of physics at University of Utah, who has come along with a design for the new locomotive.

Proposed engine would be designed to generate 7,000 hp., and would cost about $1,200,000 to build, according to Dr. Borst. Cost of a Diesel combination of comparable horsepower (at current estimates of $110/hp.) would run to about $770,000. Dr. Borst figured the cost of four Diesel 1750-hp. units as $596,000.

Comparing fuel costs on an annual basis, Dr. Borst sees the uranium engine using about $150,000 worth and Diesel about $250,000 worth. Some difference of opinion exists regarding his estimates on fuel oil. Other authorities say for 7,000 hp. costs run anywhere from $68,000 to $120,000 annually: none see costs in the $240,000 range.

No plans have yet been announced for building such a locomotive. However, a reactor design project is now on the drawing boards at Babcock & Wilcox Co., according to a recent announcement by that firms' Atomic Energy Division.

At the AEC, where officials have been aware of the Borst study but indicated that no funds nor assistance had been given, the consensus was that there will be several utility-size, atomic power plants in operation before the first nuclear-powered locomotive rolls down the tracks.

Success of the atomic battery, however, seems to portend of more interesting things for the future, even though the electric current output of this new first battery is admittedly in the "fleapower" range.

A source of energy that is truly tiny and simple of construction has many obvious advantages over a

massive, complex atom-to-steam-to-electricity power plant with its attendant, and necessary, four-foot thickness of shielding for safety purposes. Cost figures at this stage of development are still in the area of the unknown or undisclosed.

Both developments, however, present intriguing phases to the long-range future picture of the fuel and energy market and what it can mean to the oil processing industries. —W. C. U.

Economics Still a Factor in the Outlook for Fuel Oil Quality

THE outlook for improved quality in fuel oil, particularly low-ash or ash-free, is seen as depending upon what value the consumer is willing to place on such improvements.

Big users of fuel oil—power for example—have long been concerned with the high temperature corrosion problem created by fuel oil ash constituents and their effects on metals. The petroleum industry is searching and will continue to search for every means feasible within the existing price structure to improve performance quality of the residual fuel oils.

Any approach—additives, or processing to remove the ash constituents—would raise costs; and currently the price structure offers the refiner little encouragement to go this route. On the other hand, if an ash-free fuel was of sufficient value to the buyer that it could be sold at a somewhat higher price than conventional fuels, an incentive would be created and progress towards a low-ash fuel would probably be in direct proportion to the price increase.

A contributing factor to the ash problem in fuel oils is the greater concentration of ash during recent years as a result of maximizing production of the lighter petroleum products at the expense of fuel oil. Between 1946 and 1952, the average yield of residual fuel in the U. S. dropped from 24.9 to 18.6% on crude.

The steady downward trend in yields resulted from the price falling off, and that in turn has resulted from residual fuel's competing with coal and, in some areas, with natural gas. In fact, in most cases fuel oils have been selling for considerably less than the cost of the crude oil; around $1.90/bbl. vs. crude prices of $2.60-$3.00/bbl. in the same geographical location.

The low average increase in residual fuel consumption is also expected to increase. For the past six years it has been only 2½% per year as compared to approximately 8% per year for other products. The imports of residual fuels can be expected to grow. The Caribbean area has become an economical source of heavy fuel oil to help meet the needs of East Coast consumers, for example.

This means more ash problems. It means that an increasing portion of the future available residual fuel is apt to be from the Venezuelan type crudes and therefore high in vanadium content. The problem of the effect of vanadium, sodium, and other ash constituents in the fuel on high temperature power generation equipment thus takes on great significance for the future.

The solution is seen, in part at least, as resting on the manufacturer, the refinery operator, who will continue to develop better processing techniques, within economic feasiblity, for his products. But, it will also require close cooperation among the refiner and the power plant designer and the power plant operator to attain the maximum performance desired from the fuel oil of the future. —W. C. U.

Standardized Tests for Plastic Pipe Has Two-Way Benefit to Industry

THAT plastic pipe has been a development to watch has now become a commonplace. As more new basic raw materials have come out of the laboratories and pilot plants, many of the earlier shortcomings of the plastic pipe are being solved. Wider use is being made of the pipe in applications heretofore impossible because of such service limitations as temperature and pressure.

As an example of the increasing demand for plastic pipe since it first appeared on the market about 12 years ago, the number of installations has grown tremendously. Sales of plastic pipe for 1953 are expected to exceed $15,000,000, compared to a market of $500,000 in 1948.

Steel companies, recognizng the potential market for this fast-growing competition to metallic pipe, have begun to get into the field, either by buying plastic pipe manufacturers or by starting their own plastic pipe divisions.

Users—like the petroleum processing industries— can now look for improved standards. An extensive engineering research program to establish methods for evaluating plastic pipe was inaugurated late last year at Battelle Memorial Institute, Columbus, Ohio. The program is being sponsored by 29 firms in The Society of the Plastics Industry, Inc.

The program will develop effective test methods on such factors as burst strengths, safe working pressures, long range serviceability under static pressure and dynamic loading, such as occurs with water hammer and reciprocating pumps.

Materials from which Battelle will evaluate test methods for pipe include cellulose acetate butyrate, polyethylene, polystyrene, and polyvinyl chloride.

In addition to the work at Battelle, the plastic pipe makers are developing standards which it is planned will be issued through the Commodity Standards Division of the Dept. of Commerce, as voluntary industry standards on dimensional weights, sizes, and performance specifications.

Results on the Battelle program are anticipated in about two years, according to the manufacturers' committee working with the laboratory.

A two-way benefit is in the making for the petroleum processing industries from this work—first, as potential users of plastic pipe meeting the service conditions in processing; and secondly, as large suppliers of the kinds of petrochemicals that will be needed to meet the standards and specifications which will eventually be established. —W. C. U.

WHY 2 OF DENVER'S 5 REFINERIES SELECTED NICHOLSON STEAM TRAPS

may be important to you

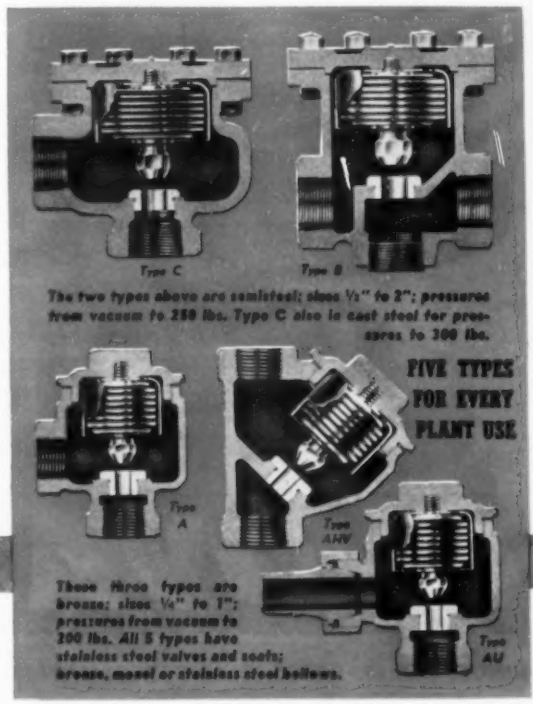
LIKE many industrial plants, the two operations referred to above had been using a considerable number of different kinds of steam traps. Both refineries have standardized on Nicholson traps, for practically all applications, for these basic reasons: Nicholson traps were found to be the most effective in improving heat transfer and in promoting production efficiency. These are advantages which, we believe, are of interest and importance to plant men in every industry.

A recent survey showed these Nicholson features to be reasons why an increasing number of leading plants are standardizing on Nicholson thermostatic traps:

1) Two to six times average drainage capacity; shorten heat-up time.
2) Operate at lower temperature differential; fast action keeps equipment full of live steam; higher and more even temperatures.
3) No air binding; eliminate costly fluctuation of operating temperatures.
4) Freeze-proof; drain completely when cold; can be freely installed outdoors.
5) Only one moving part; minimum maintenance.
6) No need to change valves for varying operating pressures from vacuum to maximum allowable.
7) Record low for steam waste; as little as 1%.

Types for every process, power and heat application.

Send for **CATALOG 953** Contains installation diagrams and data for determining proper size of trap.


Type C
Type B
The two types above are semisteel; sizes ½" to 2"; pressures from vacuum to 250 lbs. Type C also in cast steel for pressures to 300 lbs.
FIVE TYPES FOR EVERY PLANT USE
Type A
Type AHV
Type AU
These three types are bronze; sizes ¼" to 1"; pressures from vacuum to 200 lbs. All 5 types have stainless steel valves and seats; bronze, monel or stainless steel bellows.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

215 OREGON ST., WILKES-BARRE, PA.

Sales and Engineering Offices in 58 Principal Cities

HEADQUARTERS FOR SPECIAL ALLOY STEEL FLANGES

25" I.D. TO 185" O.D.

You can depend on Midvale's complete facilities—melting, rolling and forging, and machining—to produce alloy flanges to the following specifications:

All standard grades of chrome-molybdenum steel from .5% chrome—.5% moly up to and including 9% chrome and 1% moly.

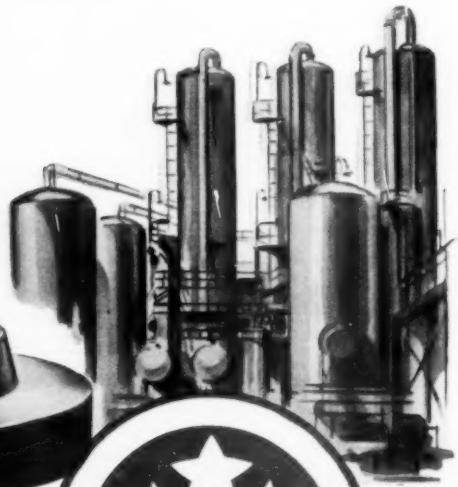
Carbon steel AISI 2317 and chrome, copper, nickel alloys to meet Charpy specifications for low temperature service.

All stainless steel generally required, such as 12-14 chrome and austenitic steels types 304, 316 and 347.

If your engineers require flanges of any unusual specifications call on Midvale.

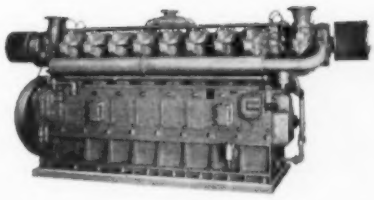
THE MIDVALE COMPANY-Nicetown, Philadelphia 40, Pa.

Offices: New York, Chicago, Pittsburgh, Washington, Cleveland, San Francisco

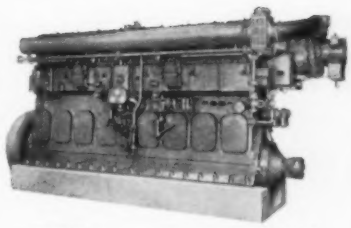


MIDVALE

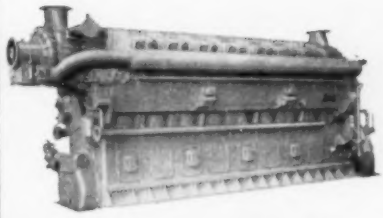
FORGINGS, ROLLS, RINGS, FLANGES, STAINLESS STEEL CASTINGS



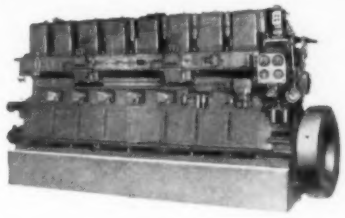
TYPE FVA ..... 8, 12 or 16 cyl.
Diesel — Atmospheric ..... 430 to 1150 hp.
Diesel — Supercharged ..... 1110 to 2230 hp.



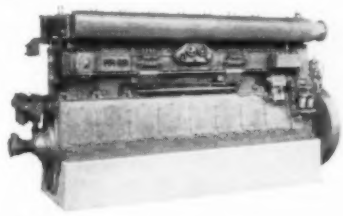
TYPE LS ..... 6, 7 or 8 cyl.
Atmospheric and Supercharged
Gas ..... 720 to 2500 hp.
Diesel ..... 825 to 2500 hp.
Gas-Diesel ..... 825 to 2500 hp.



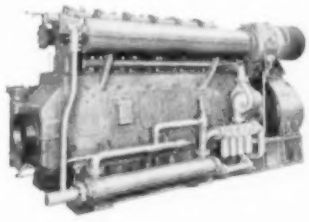
TYPE LSV ..... 12 or 16 cyl.
Atmospheric and Supercharged
Gas ..... 1440 to 5000 hp.
Diesel ..... 1650 to 5000 hp.
Gas-Diesel ..... 1650 to 5000 hp.



TYPE JS ..... 5, 6, 7 or 8 cyl.
Atmospheric and Supercharged
Gas ..... 375 to 1815 hp.
Diesel ..... 430 to 1815 hp.
Gas-Diesel ..... 430 to 1815 hp.



TYPE GS ..... 5, 6 or 8 cyl.
Atmospheric and Supercharged
Gas ..... 320 to 1460 hp.
Diesel ..... 300 to 1460 hp.
Gas-Diesel ..... 300 to 1460 hp.



TYPE FW ..... 6 cyl.
Diesel — Atmospheric ..... 245 to 500 hp.
Diesel — Supercharged ..... 350 to 835 hp.

it pays to meet power and compressor needs

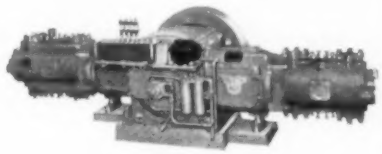
"right on the nose" . . with COOPER-BESSEMERS

• Think a moment about the importance of meeting engine or compressor needs with machines that are exactly *right* for the job. With Cooper-Bessemers you have this assurance, as evidenced by the broad range of units shown here — all standard, proved Cooper-Bessemers, engineered to give *maximum* return in any kind of service you can name, from 300 to 5,000 bhp. Note, too, the flexibility offered by each basic engine type — in number of cylinders, aspiration, horsepower range and fueling.

As important as these things are in meeting your requirements without needless waste *or* shortcomings, Cooper-Bessemers have long been known for additional plus values . . . sturdiness, long life, low maintenance and unmatched efficiencies for lower over-all cost every time! There are new bulletins, yours for the asking, to give you the latest information on Cooper-Bessemer engines or compressors just right for your needs.

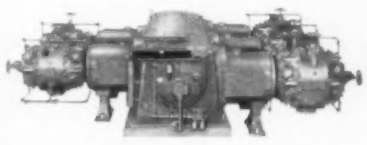
MOUNT VERNON, OHIO
COOPER-BESSEMER
GROVE CITY, PENNA.

New York Washington, D. C. Bradford, Pa. San Francisco Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle Shreveport St. Louis Los Angeles Chicago
Cooper-Bessemer of Canada, Ltd., Halifax, Nova Scotia Tulsa Gloucester, Mass. New Orleans, La.



TYPE EM
To 350 hp.
9" stroke
Speed to 514 RPM

TYPE FM
To 1500 hp.
10½" stroke
Speed to 514 RPM



TYPE JM
500 to 3000 hp.
14" stroke
Speed to 327 RPM

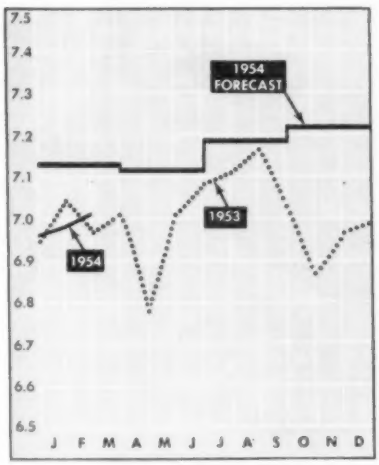
(To obtain more data on advertised products see page 424)

CATFORMING *means*

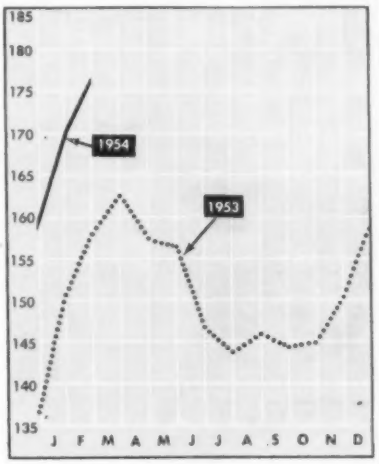
High Octanes...
High Yields...
Low Cost...
Proved Performance

These advantages of Atlantic Catforming are being demonstrated again and again in different commercial installations. We invite you to share in the benefits of Catforming. Please phone, write or wire for our detailed brochure, "CATFORMING." The Atlantic Refining Company, Research and Development Dept., P. O. Box 8138, Philadelphia, Pa.

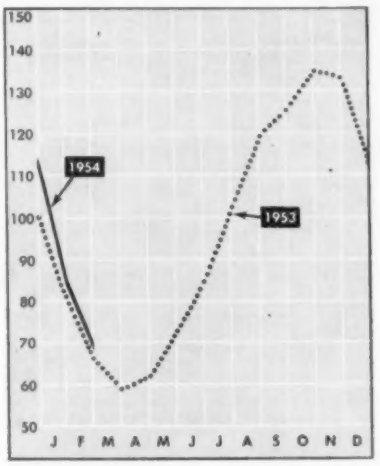
ATLANTIC *It's the Catalyst that counts*



CRUDE RUNS TO STILLS
(Millions of b/d, monthly averages)



PRIMARY GASOLINE STOCKS
(Millions of bbls., end of month)



PRIMARY DISTILLATE STOCKS
(Millions of bbls., end of month)

Gasoline Demand Soon the Pacesetter

OUTLOOK: Crude runs will trend upward—Heating oil inventories adequate for rest of season—Spring gasoline demand will hold up at the pre-1954 estimates.

Crude: Higher runs to stills are indicated. With the Texas allowable for March increased by 159,225 b/d and with heating oil stocks greatly reduced, refiners' high gasoline inventories remain the only brake on volume of operations.

Gasoline: This product will soon replace distillate fuel as the key to plant operations in coming weeks. Through the winter, running slightly less crude than the year before, refiners produced a little more gasoline, due to higher yields. Present indications are that more crude will be processed and that yields will remain around 45% for the U. S., so gasoline supply will continue high.

However, while total gasoline stocks were already the highest in history, their buildup from early October into February was actually less than in the same period the year before, because of the continuing good demand. For the U. S., the buildup was about 2,200,000 bbls. less (6%). East of California, the seasonal additions were 2,135,000 bbls. less (6.5%); for the Gulf and East Coast, nearly 500,000 bbls. more (5%); and for the interior refiners, around 2,600,000 bbls. less (11%).

A year ago, U. S. stocks built up by over 7,500,000 bbls. from Feb. 14 to April 4, 1953, and East of California by about 5,700,000 bbls. Same rate of increase this year would put U. S. stocks in early April at about 183,500,000 bbls., and East of California at close to 159,000,000 bbls., all-time highs.

Heating Oils: Withdrawals of distillates and kerosine from primary stocks from Oct. 3, 1953 to Feb. 13 for the U. S. were 14,000,000 bbls. greater (25%) than in the same weeks the year before; East of California about 12,300,000 bbls. larger (nearly 23%). In both cases, stocks remaining Feb. 13 were a few million barrels less than Feb. 14, 1953.

Residuals: Refinery output is running less than in early 1953. Refiners' stocks East of California are 4,000,000 bbls. (14%) lower than a year ago.

KEY STATISTICS

(Figures given in terms of millions of b/d, monthly averages, except stocks, which are in millions of bbls. at end of month)

	Feb. 1954	Jan. 1954	Feb. 1953
CRUDE OIL			
U. S. Production	6.205	6.188	6.562
Imports	.652	.642	.586
U.S. Stocks	266.216*	269.929	273.589
Runs to Stills	7.028	6.985	6.969
GASOLINE			
Refinery Output	3.494	3.465	3.379
Refinery Demand	3.234	3.177	3.195
Primary Stocks	177.364*	170.471	157.873
HEATING OILS			
Refinery Output	1.969	1.887	1.909
Refinery Demand	2.766	3.143	2.524
Primary Stocks	89.149*	105.101	87.635
RESIDUALS			
Refinery Output	1.220	1.221	1.275
Imports	.485	.449	.452
Total Supply	1.705	1.670	1.727
Refinery Demand	1.712	1.773	1.803
Primary Stocks	46,215*	46.355	44.178

* Feb. 20.

PRODUCT AND CRUDE PRICES

Products—¢/gal., weighted average prices in principal refinery markets
Crudes—$/bbl., principal fields
Source—Platt's Oilgram Price Service

	Feb. 1954	Jan. 1954	Feb. 1953
Gasoline	11.92	12.09	11.45
Distillate	9.21	9.03	8.59
Kerosine	10.60	10.37	9.98
Residual	4.21	4.25	3.39
Above 4 Products	9.13	9.19	8.53
Lube Oils	17.07	17.14	19.25
Crude	2.82	2.82	2.60

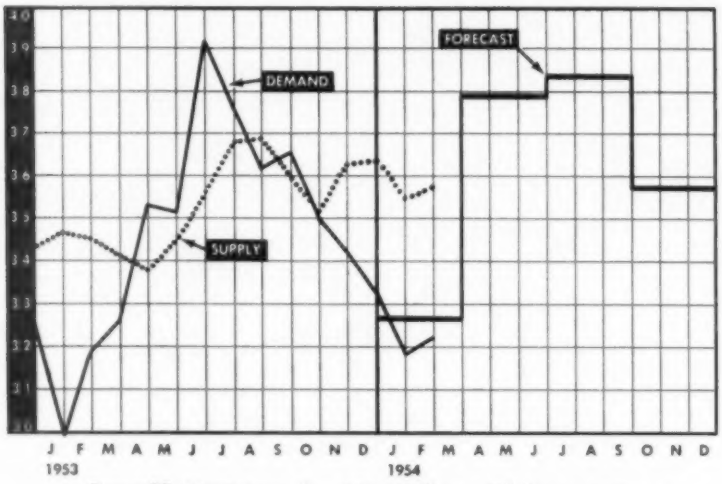
REFINERY YIELDS

% on Crude Runs to Stills

	Feb. 1954*	Jan. 1954	Feb. 1953
Gasoline	45.3	45.0	44.1
Kerosine	5.9	5.7	5.8
Distillates	22.1	21.2	21.6
Residuals	17.4	17.3	18.3

* Through Feb. 20.

SOURCE OF DATA (except prices): Jan. and Feb., API weekly reports; earlier months, Bureau of Mines.

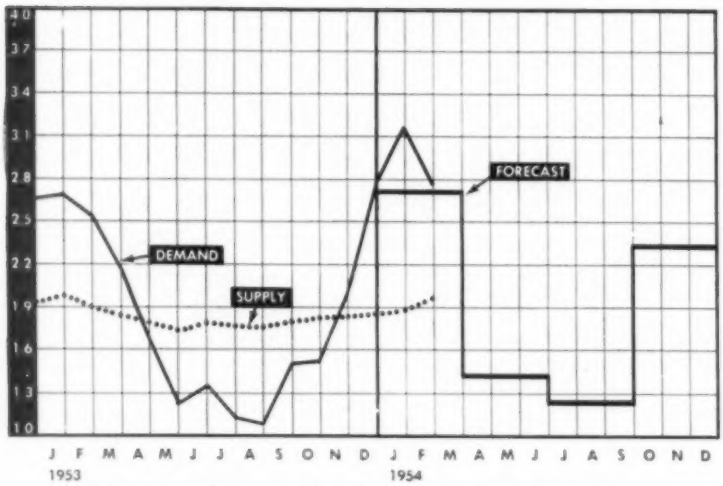


Small Upturn in Gasoline Shipments

MOTOR FUEL

SUPPLY (Millions of b/d)	From Crude	From Nat. Gas	Total
Feb. '54*	3.184	.395	3.579
Feb. '53	3.079	.378	3.457
Change	+.105	+.017	+.122
% Change	3.4	4.5	3.5
TOTAL SUPPLY (Millions of bbls.)			
12 Mos. '53	1,147.794	143.716	1,291.510
12 Mos. '52	1,052.018	140.079	1,192.097
Change	+95.776	+3.637	+99.413
% Change	9.1	2.6	8.3
DEMAND (including Exports)(Millions of b/d)			
Feb. '54*			3.234
Feb. '53			3.195
Change			+.039
% Change			1.2
TOTAL DEMAND (including Exports)(Millions of bbls.)			
12 Mos. '53			1,268.258
12 Mos. '52			1,193.565
Change			+74.693
% Change			6.3

* Through Feb. 20.

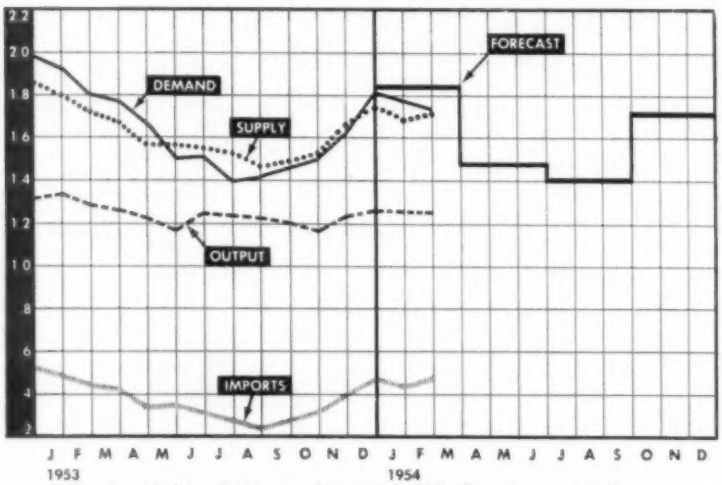


Seasonal Drop in Heating Oil Demand

HEATING OILS

	Kerosine	Dist. Fuels	Total
PRODUCTION (Millions of b/d)			
Feb. '54*	.415	1.554	1.969
Feb. '53	.404	1.505	1.909
Change	+.011	+.049	+.060
% Change	2.7	3.2	3.1
TOTAL PRODUCTION (Millions of bbls.)			
12 Mos. '53	129.858	532.415	662.273
12 Mos. '52	132.300	520.378	652.678
Change	−2.442	+12.037	+9.595
% Change	1.8	2.3	1.5
DEMAND (including Exports)(Millions of b/d)			
Feb. '54*	.541	2.225	2.766
Feb. '53	.512	2.012	2.524
Change	+.029	+.213	+.242
% Change	5.7	10.6	9.6
TOTAL DEMAND (including Exports)(Millions of bbls.)			
12 Mos. '53	127.285	521.361	648.646
12 Mos. '52	132.546	512.862	645.408
Change	−5.261	+8.499	+3.238
% Change	4.0	1.6	0.5

* Through Feb. 20.



Residual Supply Parallels Demand

RESIDUAL FUELS

SUPPLY (Millions of b/d)	Refinery Output	Imports	Total
Feb. '54*	1.220	.485	1.705
Feb. '53	1.275	.452	1.727
Change	−.055	+.033	−.022
% Change	4.3	7.3	1.3
TOTAL SUPPLY (Millions of bbls.)			
12 Mos. '53	448.868	134.383	583.251
12 Mos. '52	453.897	128.479	582.376
Change	−5.029	+5.904	+.875
% Change	1.1	4.6	0.2
DEMAND (including Exports)(Millions of b/d)			
Feb. '54*			1.712
Feb. '53			1.803
Change			−.091
% Change			5.0
TOTAL DEMAND (including Exports)(Millions of bbls.)			
12 Mos. '53			587.302
12 Mos. '52			582.866
Change			+4.436
% Change			0.7

* Through Feb. 20.

SOURCE OF DATA: Dec., Jan. and Feb., API weekly reports; earlier months, Bureau of Mines.

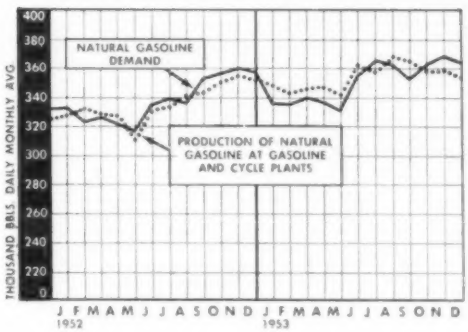
RUNS TO STILLS AND DISTRIBUTION OF PRIMARY STOCKS BY U.S. REFINERY DISTRICTS

(Primary stocks include those at refineries, at large terminals and in pipelines; all data based on API reports)

District	RUNS TO STILLS (Millions of b/d average for week ending on date shown) Feb. 20 1954	Feb. 21 1953	Change	% Change	GASOLINE STOCKS (Millions of bbls., on date shown) Feb. 20 1954	Feb. 21 1953	Change	% Change	RESIDUAL STOCKS (Millions of bbls., on date shown) Feb. 20 1954	Feb. 21 1953	Change	% Change
East Coast	1.013	1.078	— .065	6.0	34.604	34.819	— .215	0.6	9.161	11.493	—2.332	20.3
Gulf Coast	2.358	2.262	+ .096	4.2	36.798	28.755	+ 8.043	27.9	6.958	7.519	— .561	7.4
Total Coastal	3.371	3.340	+ .031	0.9	71.402	63.574	+ 7.828	12.3	16.119	19.012	—2.893	15.3
Appalachian	.213	.201	+ .012	6.0	6.502	6.400	+ .102	1.6	.897	.775	+ .122	15.8
Ind.-Ill.-Ky.	1.339	1.308	+ .031	2.4	38.756	36.064	+ 2.692	7.5	4.278	4.384	— .106	2.4
Okla.-Kans.-Mo.	.597	.586	+ .011	1.9	19.188	17.201	+ 1.987	11.5	1.100	1.142	— .042	3.7
Other Inland	.611	.606	+ .005	0.8	18.756	16.359	+ 2.397	14.6	2.147	1.985	+ .162	8.1
Total Inland	2.760	2.701	+ .059	2.2	83.202	76.024	+ 7.178	9.4	8.422	8.286	+ .136	1.6
Total East of Calif.	6.131	6.041	+ .090	1.5	154.604	139.598	+15.006	10.8	24.541	27.298	—2.757	10.1
California	1.025	1.038	— .013	1.3	22.760	16.259	+ 6.501	40.0	21.674	17.066	+4.608	27.0
Total U.S.	7.156	7.079	+ .077	1.1	177.364	155.857	+21.507	13.8	46.215	44.364	+1.851	4.2

District	DISTILLATE STOCKS (Millions of bbls., on date shown) Feb. 20 1954	Feb. 21 1953	Change	% Change	KEROSINE STOCKS (Millions of bbls., on date shown) Feb. 20 1954	Feb. 21 1953	Change	% Change	TOTAL HEATING OIL STOCKS (Millions of bbls., on date shown) Feb. 20 1954	Feb. 21 1953	Change	% Change
East Coast	24.786	25.706	— .920	3.6	8.007	9.322	—1.315	14.1	32.793	35.028	—2.235	6.4
Gulf Coast	9.659	10.770	—1.111	10.3	3.367	3.785	— .418	11.0	13.026	14.555	—1.529	10.5
Total Coastal	34.445	36.476	—2.031	5.6	11.374	13.107	—1.733	13.2	45.819	49.583	—3.764	7.6
Appalachian	1.616	1.611	+ .005	0.0	.884	.798	+ .086	10.8	2.500	2.409	+ .091	3.8
Ind.-Ill.-Ky.	11.157	11.181	— .024	0.2	4.697	4.851	— .154	3.2	15.854	16.032	— .178	1.1
Okla.-Kans.-Mo.	7.004	8.087	—1.083	13.4	1.050	1.146	— .096	8.4	8.054	9.233	—1.179	12.8
Other Inland	4.109	4.145	— .036	0.9	1.073	1.084	— .011	1.0	5.182	5.229	— .047	0.9
Total Inland	23.886	25.024	—1.138	4.5	7.704	7.879	— .175	2.2	31.590	32.903	—1.313	4.0
Total East of Calif.	58.331	61.500	—3.169	5.1	19.078	20.986	—1.908	9.1	77.409	82.486	—5.077	6.2
California	11.397	9.930	+1.467	14.6	.343	.371	— .028	7.6	11.740	10.301	+1.439	13.9
Total U.S.	69.728	71.430	—1.702	2.4	19.421	21.357	—1.936	9.1	89.149	92.787	—3.638	3.9

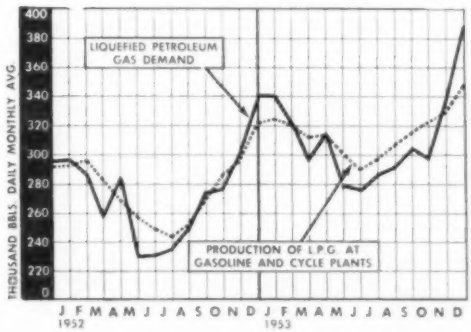
Supply and Demand of Natural Gas Liquids



Natural Gas Liquids Statistics

(Source: U.S. Bureau of Mines Report on Natural Gasoline and Cycle Plant Operations)

	SUPPLY* (1000 b/d avg.) Natural Gasoline	LPG	TOTAL	DEMAND** (1000 b/d avg.) Natural Gasoline	LPG	TOTAL
Dec. '53	357	348	705	363	388	751
Dec. '52	353	323	676	359	340	699
Change	+4	+25	+29	+4	+48	+52
% Change	1.1	7.7	4.3	1.1	14.1	7.4
	Total Supply (1000 bbls.)			Total Demand (1000 bbls.)		
12 Mos. '53	129,331	114,913	244,244	128,033	113,362	241,395
12 Mos. '52	123,463	102,033	225,496	123,863	99,429	223,292
Change	+5,868	+12,880	+18,748	+4,170	+13,933	+18,103
% Change	4.7	12.6	8.3	3.4	14.1	8.1



Stocks, End of Month (1000 bbls.)

	By type of product (At gasoline plants and terminals only) LPG	Natural Gasoline	Condensate	Finished Gasoline†	By Location Gasoline Plants	Refineries	Total
Dec. '53	3,742	3,022	304	1,505	8,573	1,855	10,428
Nov. '53	4,973	3,223	310	1,467	9,973	2,250	12,223
Oct. '53	5,172	3,739	229	1,266	10,406	2,787	13,193
Dec. '52	2,191	2,011	315	1,207	5,724	2,083	7,807

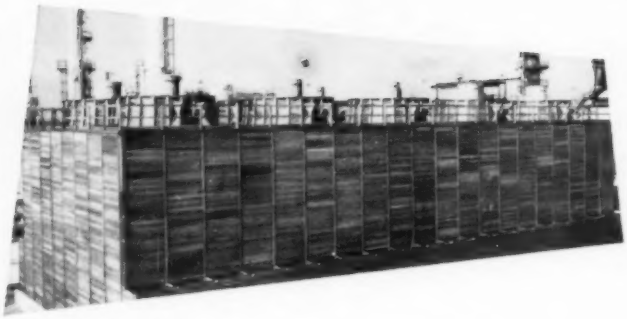
* Supply includes receipts from refineries as well as current production from natural gasoline and cycling plants. Receipts from refineries in December included 154,000 bbls. of natural gasoline.

** Demand does not include liquefied refinery gases produced for fuel and chemical purposes, which totaled 2,811,000 bbls. in December.

† Includes naphtha and other products.

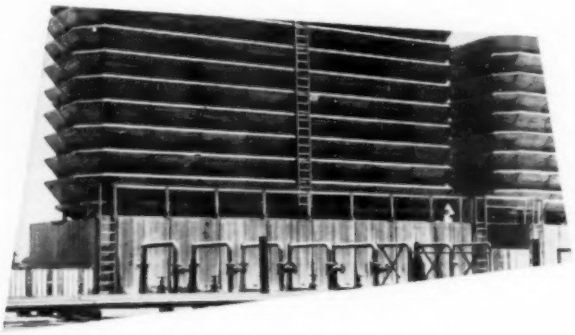
YOU CAN SAVE A LOT OF MONEY...

. . . in the vital cooling processes of your refinery operation. How? Install a Pritchard Cooling Tower! Each of the hundreds of Pritchard cooling towers operating throughout the petroleum industry was designed, built . . . *and guaranteed* . . . to do a specific job. Such accurate design, engineering and construction result in operating efficiencies that assure proper cooling with maximum savings. And the hundreds of satisfied customers enjoying these savings are proof that you can depend on Pritchard—a founder member of the Cooling Tower Institute—for the right answer to any cooling problem *you* have.



18,760 gpm of refinery process water are cooled from 120° F. to 85° F. in this Pritchard induced draft cooling tower at the Pure Oil Company refinery, Toledo, Ohio.

The 16 cells of this induced draft Pritchard tower, built for the Ohio Oil Co., Robinson, Ill., are divided into 9 sections, each designed for a different cooling performance. Total design capacity is 48,000 gpm.



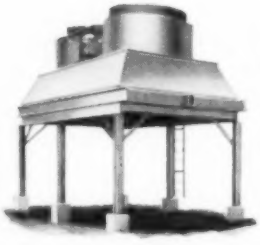
This Pritchard atmospheric cooling tower is cooling process water from an initial temperature of 105° F. to a final temperature of 90° F. for the Sunray Oil Company at Placedo, Texas.

Industry's Partner for Progress

J. F. Pritchard Co.
OF CALIFORNIA
A DIVISION OF J. F. PRITCHARD & CO.
Dept. 350 210 West 10th St., Kansas City 5, Mo.

COOLING TOWERS
SPECIALIZED HEAT EXCHANGERS
GAS & AIR TREATING EQUIPMENT

Representatives in Principal Cities from Coast to Coast



In other cooling operations, you'll obtain maximum heat transfer . . . with maximum savings . . . from Pritchard QUINTAIR* heat exchangers. The induced draft arrangement allows more even distribution of air over the surface of the coils carrying the product to be cooled or condensed.

*Registered Trade Name

DU PONT REG. U. S. PAT. OFF.

PETROLEUM CHEMICALS DIVISION

NEWS

DU PONT REG. U. S. PAT. OFF.

March ★ One of a Series of Interest to the Petroleum Industry ★ 1954

"Cavalcade of America" Films Available For Oil Company Use

The story of men and women who helped to shape the dynamic, adventurous growth of America has been brilliantly dramatized on film for Du Pont's television series, "Cavalcade of America."

So far, more than 30 of these historical-interest films have been produced. Their subjects range all the way from the Louisiana Purchase to "Teddy" Roosevelt's early days in the Dakota badlands . . . from pirate Jean Lafitte's part in the defense of New Orleans to Samuel F. B. Morse's invention of the telegraph.

Many of the films deal with the people—and their ideas—who laid the foundation for our tremendous industrial progress. For example, the story of how Eli Whitney became the first mass production manufacturer of firearms . . . how Samuel Slater became the father of the American factory system . . . and how Tom Davenport, a blacksmith, created the first electric motor.

These 28-minute films are ideal for public relations showings. You may also find them useful for entertainment at dealer meetings. Any Du Pont Petroleum Chemicals Division representative or regional office will be glad to help you obtain any of these films on a loan basis.

SALES PROMOTION MANAGER

ROBERT F. HARWICK joined the Du Pont Company in 1950 and was appointed Sales Promotion Manager of the Petroleum Chemicals Division the following year. He brought to this job a broad oil industry experience—ranging all the way from manufacturing to editorial work with a petroleum publication.

ROBERT F. HARWICK

In 1934, Mr. Harwick started with the Gulf Refining Company as a unit operator at their Girard Point Refinery. He was later transferred to the Company's advertising and sales promotion staff at Pittsburgh. In 1948, he joined the *Oil and Gas Journal* as West Coast editor.

At Du Pont, he has been in charge of such customer service projects as the Brand Name Program and the Survey of Consumer Gasoline Buying Habits.

A graduate of Drexel Institute with a B.S. degree in Chemical Engineering, Mr. Harwick served for four years with the U. S. Army during World War II.

Do Service Station Services Help Increase Dollar Sales?

Report No. 6 of Du Pont's continuing Survey of Consumer Gasoline Buying Habits points up the relationship between dealer services and volume of product sales

Changing the vocabulary of millions of motorists is a tough job. But gasoline marketers have been highly successful in doing it. What was once known as a "gas station" or "filling station" is today thought of and referred to as a "service station."

In accomplishing this name change, service has become an important part of gasoline marketing. But does it pay off in sales? Report No. 6 on Du Pont's extensive Survey of Consumer Gasoline Buying Habits contains statistics to take the answer to this question out of the "hunch" category.

THE IMPORTANCE OF SERVICE as a service station sales stimulant is highlighted in Report No. 6 of the Du Pont Survey of Consumer Gasoline Buying Habits.

Report No. 6 covers specifically services given by dealers and services wanted by the motorist. Based on 3,100 household interviews and 21,000 observations at 1,193 service stations, the survey was conducted by National Analysts, Inc. It is countrywide in scope.

Importance Of Oil Check

All of the motorists interviewed were asked what they considered the *most important* dealer service. *Oil check* was the answer given by more than 90% of them.

And the station observations showed that the more often oil was checked by the station attendant, the more often oil was sold. Yet only a small percentage of the total number of customers were *offered* an oil check. Many of

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED *Service Survey*

them *had to ask* for it. And the largest percentage of motorists neither asked for nor were offered an oil check.

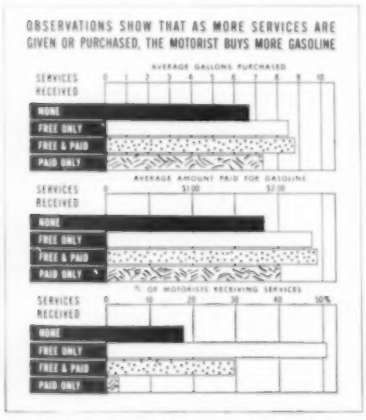
Who Was Offered An Oil Check?

Owners of newer and more expensive cars were offered the oil check more frequently than owners of older cars. Yet, the chances are that the older cars are more likely to need additional oil between changes . . . and therefore represent a greater potential market for oil.

In addition to oil check, Report No. 6 covers consumer attitudes toward many other important dealer services—both free and paid. You'll find in it detailed information on the number of motorists who *expect* to have their windshields cleaned with every stop . . . how many motorists would like to have tire pressure and battery water checked more frequently . . . and even the relationship of these services to tire and battery sales. It also contains data on paid services . . . plus data on the stimulating effect of these services on sales.

Sales-Service Ratio

The station observations show that the motorists who received the most service purchased the most gasoline. On the

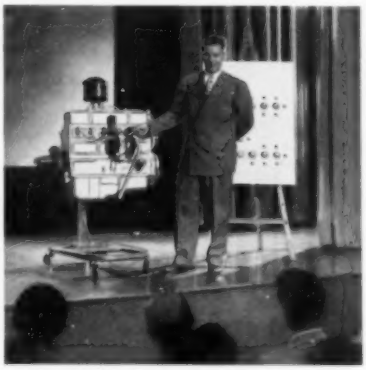


A TYPICAL CHART from Report No. 6 shows the relationship between free and paid services and gasoline sales.

average, motorists who received free service bought 2 gallons of gasoline more than those who received no service at all. And those who received paid service purchased, on the average, slightly less than one gallon more than those who received no service at all.

Engineering Talks On Automotive Service Problems

As an aid to oil company fuel and lubrication engineers, personnel from the Technical Section of the Du Pont Petroleum Chemicals Division are prepared to conduct a technical conference on automotive service problems.



The conference is designed for those directly concerned with the performance of fuels and lubricants in the field. And it is expected that the material covered in the conference will prove extremely helpful to these engineers in answering customer complaints involving service problems.

Broad Range Of Topics

Five important topics are covered in the conference: 1. exhaust valve burning; 2. induction system deposits; 3. road testing of gasoline; 4. ignition system and spark plug fouling; 5. engines and their octane requirements. The individual talks range in length from 35 to 50 minutes. And the complete conference takes about half a day.

The fundamental principles underlying the specific operating problem are covered in each talk. The speakers use these principles to explain the problems in a manner which suggests methods of assuring trouble-free operation.

Experienced Speakers

Each talk is given by a well-qualified member of the Petroleum Chemicals Division's technical staff. All have had years of experience in their respective subjects in the Du Pont laboratories, in oil refineries and in technical service activities.

The talks, however, are informal and easy to follow. Each speaker is well trained in public speaking. And the talks are amply illustrated with colored slides.

Available To Oil Companies

This conference is available to any oil company. And it may be scheduled for any time at a location most convenient for the audience. If you are interested in obtaining the conference for your automotive service group, you may request it from any Du Pont Petroleum Chemicals Division regional office or representative. To insure that all speakers are available, we suggest that you make arrangements well in advance.

Complete Information Available

In addition to Report No. 6 which is now being distributed to marketing executives, the full and complete information collected by this survey on services is recorded on IBM cards. This information can be cross tabulated to provide seasonal, regional, and other specialized breakdowns. These cross tabulations are available to oil company market research groups through the Petroleum Chemicals Division's Wilmington office.

The Survey of Consumer Gasoline Buying Habits is part of a continuing Du Pont marketing study program. Work is already under way on a new study which will contrast dealer attitudes and beliefs with those of consumers.

DU PONT
Better Things for Better Living
. . . through Chemistry
Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • *Wilmington 98, Delaware*

Regional Offices:
NEW YORK, N. Y.—1270 Ave. of the Americas — Phone COlumbus 5-3620
CHICAGO, ILL.—8 So. Michigan Blvd. — Phone RAndolph 6-8630
TULSA, OKLA.—1811 So. Baltimore Avenue — Phone Tulsa 5-5578
HOUSTON, TEXAS—705 Bank of Commerce Bldg. — Phone PReston 2857
LOS ANGELES, CALIF.—612 So. Flower St. — Phone MAdison 1691

IN CANADA: Canadian Industries Limited—Toronto, Ont.—Montreal, Que.—Calgary, Alta.
OTHER COUNTRIES: Petroleum Chemicals Export—Nemours Bldg., 6539—Wilmington 98, Del.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-6786

Printed in U.S.A

PROCESS EQUIPMENT NEWS

PUBLISHED BY FABRICATED PRODUCTS DIVISION, THE M. W. KELLOGG COMPANY FEB.-MAR. 1954

EXCHANGER DESIGNED FOR HIGH PRESSURE DIFFERENTIAL

A pressure differential of approximately 1300 pounds per square inch across the tube sheet is one of the unusual conditions to be provided for in a carbon dioxide condenser currently under construction in Kellogg's fabrication shops for a leading chemical processor.

The condenser consists of two shells, 18 inches in diameter, of forged integral channel fixed tube sheet construction. The tubes, 250 per bundle, are of $\frac{3}{4}$-inch admiralty, 20 feet long. The shell cover, channel, and tube sheets are all of steel.

In operation, water will circulate in the tubes at a design pressure of 80 psig. to condense approximately 30,000 lbs. per hour of carbon dioxide under a pressure of 1400 psig.

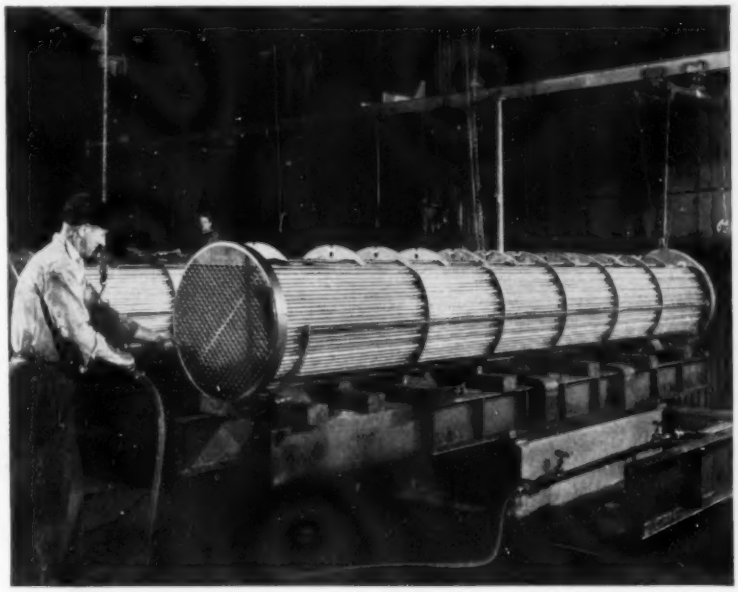
Just one of scores of exchangers, condensers, coolers, and reboilers that annually come out of its shops, this job illustrates one of an infinite number of extreme conditions Kellogg is experienced and equipped to meet in designing and fabricating process equipment.

For further information, details of methods, etc. contact

FABRICATED PRODUCTS DIVISION
THE
M. W. KELLOGG
COMPANY
225 Broadway, New York 7, N. Y.

also Jersey City, Buffalo, Chicago, Los Angeles, Tulsa, Houston
In Canada—Toronto and Edmonton
In Europe—London and Paris

KELLOGG PULLMAN



Fourteen Shells for Three Condensers to Have Interchangeable Bundles

Three condensers currently being engineered by Kellogg for a major refiner will represent an optimum in interchangeability of bundles—a feature every refiner wants but one that is often difficult to achieve in a unit without over-engineering it.

The three condenser units, designed to handle C-4 cuts, comprise a total of 14 shells. Following normal design practices, initial Kellogg engineering proposals included three sizes of shells. However, further study by Kellogg engineers proved, in this instance, that it would be most economical in the long run to design the entire group of 14 shells for interchangeable bundles. Both proposals were submitted, the customer agreeing that the interchangeable bundle plan best served their purposes.

Each of the 14 sections are of floating tube sheet construction with 2040 square feet of $\frac{3}{4}$-inch admiralty tubes, naval brass tube sheets, and steel baffles. Inside diameter of each shell is 33 inches. The sections are all designed for 500 degrees F. on the shell side, 300 degrees F. on the tube side, and 300 psig. on one side.

Interchangeable bundles for this many sections will offer several important advantages to the refiner. They will, for example, cut down considerably on refinery maintenance stock, since only one *spare* bundle need be kept in stock to service any one of the 14 sections. Shorter down time for repairs are also expected to result from the fact that the spare bundle can be substituted easily in an emergency without shutting the unit down for lengthy repairs or rebuilding.

. . . An Exact Bevel

One of the two reflux reboiler shells being fabricated in Kellogg's Jersey City shop for a major petroleum refiner. Here a nozzle is being welded to the shell—the final operation that demands the utmost in precision. Holes for these nozzles have been cut with an exact bevel so that a perfect joint results when welding is completed.

IT FLOATS ON THE LOAD!*

You turn on the steam.

This little stainless steel valve—the only moving part in the Yarway Impulse Steam Trap installed on the equipment—opens wide and *stays* open as the air and condensate continuously pour through.

The equipment reaches production temperature in the quickest possible time.

Production temperature reached, the little valve snaps shut. After that, by a pulsating action, it discharges all condensate as it forms—even a tiny teaspoonful. *There's hot steam in the equipment all the time . . .* steady, maximum temperatures are maintained.

It all adds up—to more production per day.

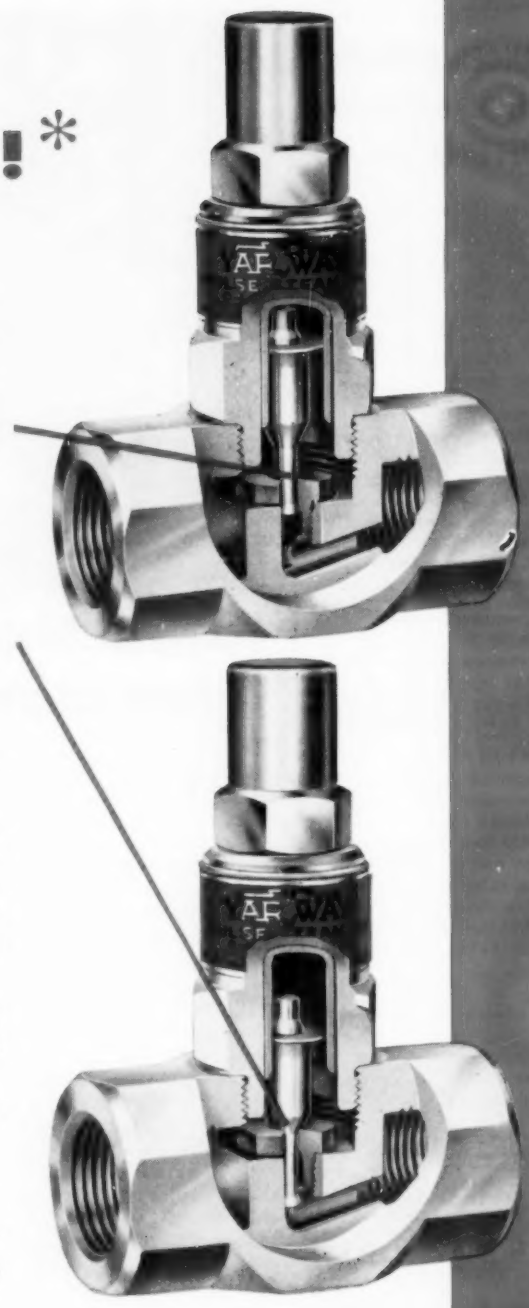
Other profit-making features of the Yarway Impulse Steam Trap—low initial cost, easy installation, stainless steel construction, low maintenance, good for all pressures, quick delivery from over 200 local industrial distributors.

Try a Yarway—free for 60 days—and *prove* its advantage. Your distributor will supply you.

For free Yarway Impulse Steam Trap Bulletin T-1740, write . . .

YARNALL-WARING COMPANY
153 Mermaid Ave., Philadelphia 18, Pa.

. . . resulting in fast heat-up of equipment, more production per day.



YARWAY | *impulse steam trap*

LIGHT IN THE NIGHT...

Spearing across the snows
of Canada shines this headlight.
But for refractory brick,
the arc wouldn't spark to flash
the headlight, the stainless
steel with which the car is built
would not exist... the trucks
she rides on, the motors and the
generators, even the glass...
depend for their existence upon
quality refractories
such as Grefco supplies
the world.

Budd Rail Diesel Car on the
Canadian Pacific Railway

GENERAL
REFRACTORIES
COMPANY
Philadelphia

Products of fame... wherever there's flame

GENERAL REFRACTORIES COMPANY

This valve is used in washing operations. Wash water is injected into the tubing here. Washing operations and product storage are being carried out simultaneously.
The displaced brine emerges through this tubing valve. To remove Butane from the well, brine is injected through tubing here.
This is the wash liner valve through which the effluent brine passes in washing operations.
In storing Butane the product is injected into the casing through this valve. Displaced Butane emerges through this valve when the product is being recovered.

ORBIT Forged Steel VALVES

On Butane Storage Well Hook-up

Where brine conditions are encountered specify Stainless Steel Trim Orbit Forged Steel Valves.

A familiar sight these days — wherever you see hydrocarbon ground storage operations you see Orbit Forged Steel LP Gas Valves being used.

Orbit valves have proved themselves in LP gas service and are known and accepted by operators as being a reliable, safe component in processing, handling and storage of hydrocarbons.

Orbit Forged Steel LP Gas Valves are available in sizes: 1″, 1½″, 2″, 2½″, 3″ and 4″ ASA ratings beginning at 150 lb., to and including 2500 lb. flanged and screw end, full opening, carbon steel trim or stainless steel trim. Maximum rated working temperature 250 degrees Fahrenheit.

ORBIT VALVES ®

ORBIT VALVE COMPANY

P. O. BOX 699 **TULSA, OKLAHOMA**

• BRANCHES •

HOUSTON, TEXAS
407 Velasco
(Serving the Gulf Coast)

CASPER, WYOMING
1740 E. Yellowstone
(Serving the Rocky Mountain States and Canada)

ODESSA, TEXAS
402 West County Road
(Serving West Texas)

Carey 85% MAGNESIA INSULATIONS

RIDE HERD ON COSTS FOR GULF IN TEXAS

. . . still going strong after 24 years of tough refinery service

At Gulf's Port Arthur, Texas, refinery, miles of Carey insulation keep fluids at constant temperature, save thousands of fuel dollars . . . help Gulf refine better products at less cost!

This record of service dates from 1929, *yet the original insulation is still on the job* . . . still *riding herd* on costs after 24 years of punishment by blistering sun, blustering wind, and unmerciful vibration, expansion and contraction of equipment.

Development and manufacture of products to conserve heat and power has been an important Carey contribution to industry since 1873. That's why we believe we can solve your heat and power conservation problems, unusual though they may be.

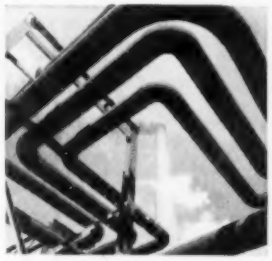
The Carey line of high and low temperature insulations includes new, monolithic Super-Light 85% magnesia in precision-sized blocks and nesting "O.D." pipe coverings, blankets, pipe wrapping and jackets, blocks, loose and granulated wool, and cements.

Let Carey help you plug up those dollar-leaks. Use coupon to request the latest bulletins describing Carey insulating products or the services of a qualified Carey Industrial Sales Engineer.

More recent Gulf Oil installations have been made by: B & B Engineering & Supply Co., Insulation Contractors, Houston, Texas; The Lummus Co., Engineering Contractors, New York City, N. Y.

Carey Insulation has weathered 24 years of continuous service on the fractionating tower and vapor lines of these atmospheric and vacuum stills at Gulf Oil Corporation's Port Arthur, Texas plant.

Another Carey product—Careystone Corrugated Asbestos-Cement Roofing and Siding—protects Gulf Oil Corporation's warehouse at Port Arthur, Texas. Careystone won't corrode, rot, rust or decay; never needs paint or preservative treatments; is virtually maintenance-free!



"Worm's eye" view of live and exhaust steam lines insulated with Carey insulations. Besides the usual hazards of expansion, contraction and vibration, this Carey installation stands up under the extremely hot, humid weather of the Gulf area.

FROM THE HOUSE OF CAREY

Insulation • Built-up Roofing • Careystone Roofing and Siding • Careyduct • Asphalt Plank • Asphalt Paints and Coatings • Industrial Flooring • Other Famous Products for Industry Since 1873

Carey

The Philip Carey Mfg. Company, Lockland, Cincinnati 15, Ohio
In Canada: The Philip Carey Co., Ltd, 277 Duke St., Montreal 3, P. Q.

FILL IN AND MAIL THIS COUPON TODAY

The Philip Carey Mfg. Company
Department **PE-3**
Lockland, Cincinnati 15, Ohio

☐ *Please send me latest technical bulletins describing Carey industrial insulation products and their uses.*

☐ *Please have a Carey Industrial Sales Engineer call on me.*

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE___ STATE_____

(To obtain more data on advertised products see page 424)

no crossroads in our business

Universal develops new processes and perfects new refining techniques for one purpose only—that of making them immediately available to every petroleum refiner so that refinery economics may be improved and better products may be made from petroleum.

An excellent example of this policy is the Platforming process. Just as soon as the process was developed and perfected it was offered to the entire petroleum refining in-

dustry so that refiners could quickly apply it to their individual needs. Likewise, as improvements were made in both the process and operating techniques, the information was available to each Platforming licensee.

This is typical of Universal's continued interest in the refiner's welfare. The success of our company depends almost completely upon our ability to help him—to provide processing advances that will permit the refiner to improve his products and his position as a major factor in the economy of America and the world.

There are No Crossroads In Our Business. The path is straight and well defined, leading to but one goal—that of providing a comprehensive service through which the petroleum refiner can benefit to the greatest possible degree.

UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD, DES PLAINES, ILL., U. S. A.
Laboratories: RIVERSIDE, ILLINOIS

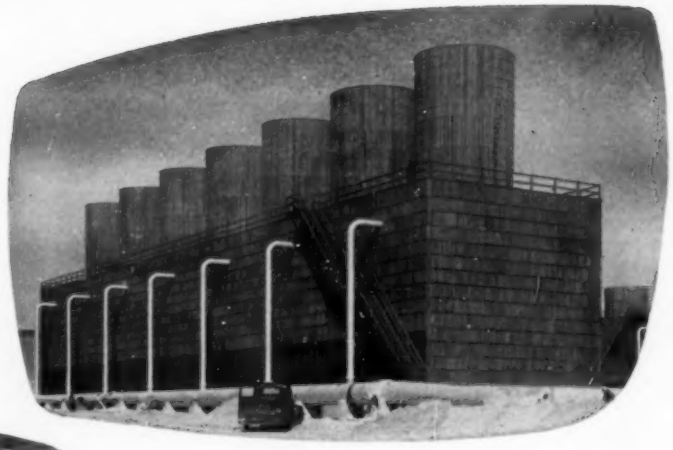
Universal Service Protects Your Investment

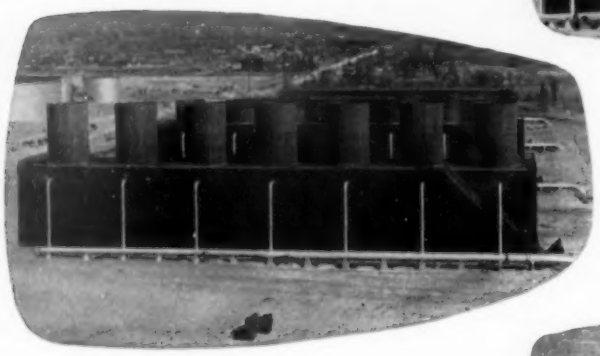
(To obtain more data on advertised products see page 424)

FLUOR *is building*

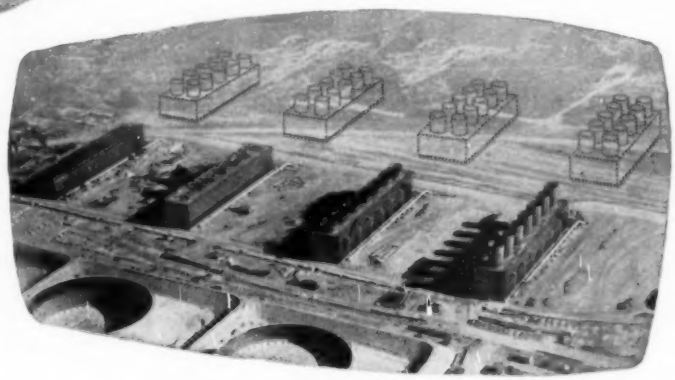
the world's largest initial

cooling tower installation





These Fluor Counterflo Cooling Towers are now being erected in the San Fernando Valley at the site of the new 512,000 KW steam-electric generating plant for the Department of Water and Power, City of Los Angeles. They comprise the largest initial cooling water circulating system utilizing cooling towers ever built.



The power plant itself is the largest initial installation inland and is being constructed in two sections. The first section consists of two units of 100,000 KW each, the second section of two units of 156,000 KW each. The four Fluor towers shown here (28 cells) in progressive stages of erection, are designed at 36,000 g.p.m. each, with a maximum of 42,000 g.p.m. They will service the first section of the plant. Design cooling range is 14° F with water entering at a temperature of 95° F and leaving at 81° F. The design wet bulb temperature is 70° F. Heat load is 1 billion B.t.u./Hr. for the first four towers.

Each cooling tower is 250 ft. long, 42 ft. wide and 37.5 ft. high to the fan deck. Twenty-foot, four-bladed fans are driven by 40 H.P. motors. Each fan moves 436,000 CFM. Capacity rating is 144,000 g.p.m. through a low pressure water distributing system. A distinctive feature of these towers is the Fluor-designed redwood stack standing 30 ft. high to minimize recirculation at peak load conditions.

Ground has been broken for the erection of four additional Fluor towers to serve the second section of the plant. Each tower will consist of 5 double-cells for a total of 40, with water circulation of 136,800 g.p.m. Design duty: inlet temperature 101° F, outlet 80° F, wet bulb 70° F. Heat load is 1,440,000,000 B.t.u./Hr. Dimension of these towers: 180 ft. long, 66 ft. wide, 45 ft. high to fan decks. Fans (18 ft.) will be driven by 40 HP motors and each will move approximately 350,000 CFM.

In addition, an auxiliary system (the bearing cooling water) employs a 4-cell Fluor Tower with a heat load of 40 million B.t.u./Hr.

When completed, total cooling water circulation will exceed 280,000 g.p.m. and *will circulate over 240 miles of condenser copper tubing*. Total heat load will approach 2½ billion B.t.u./Hr. The big jobs can be entrusted to Fluor, a firm with 33 years experience in the design and manufacture of cooling towers for every type of service. For complete details on Fluor Cooling Towers, write for the new illustrated bulletin, "Cooling Water for Industry."

FOUNDER MEMBER
CTI
COOLING TOWER INSTITUTE

BE SURE WITH

FLUOR

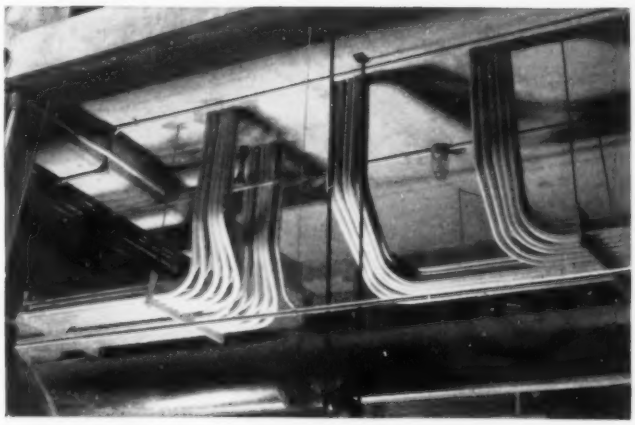
THE FLUOR CORPORATION, LTD.
LOS ANGELES 22, CALIFORNIA

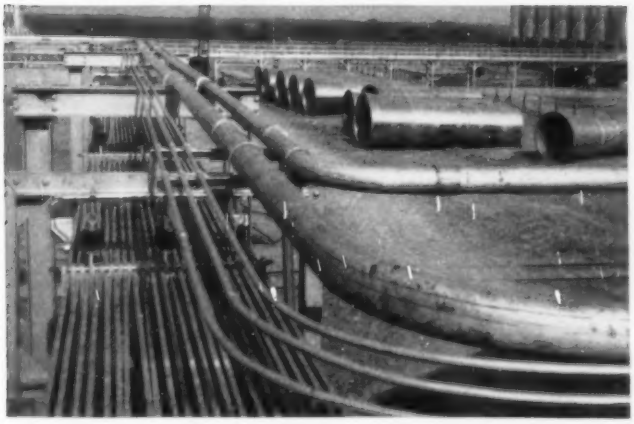
FOREIGN: FACTS-FLUOR - PARIS
FLUOR OF CANADA - TORONTO
FLUOR INTERNATIONAL - BEIRUT
FLUOR PERUANA, S.A. - LIMA
HEAD WRIGHTSON - LONDON

ENGINEERS
CONSTRUCTORS
MANUFACTURERS

NEW YORK
CHICAGO
PHILADELPHIA
BOSTON
PITTSBURGH
SAN FRANCISCO
HOUSTON
BIRMINGHAM
TULSA

THE LOWEST COST CORROSION RESISTANT NONMAGNETIC CONDUIT YOU CAN BUY!





CORROSION RESISTANT

Alcoa® Aluminum Electrical Rigid Conduit is especially resistant to most industrial atmospheres that often attack other metals. The excellent performance of aluminum conduit in corrosive conditions means lower maintenance costs and less frequent replacement.

NONMAGNETIC

Alcoa Aluminum Electrical Rigid Conduit is nonmagnetic. This results in lower voltage drop, eliminates overcrowding of terminal enclosures and simplifies the installation of electrical equipment having widely spaced terminals.

LIGHTWEIGHT

Alcoa Aluminum Electrical Rigid Conduit reduces handling, fabricating and installation costs. It is only about one-third the weight of the same size in steel. A 10′ length of 4″ diameter weighs only 40 pounds and can easily be handled by one man.

EASY INSTALLATION

Alcoa Aluminum Electrical Rigid Conduit can be installed with only slight modifications in standard practices. ALUMINUM COMPANY OF AMERICA, 2093-C Alcoa Bldg., Pittsburgh 19, Pa.

For complete information write for Alcoa's new booklet, *Alcoa Aluminum Electrical Rigid Conduit.*

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

QUENCHED NUT

The Bethlehem Quenched Nut is no ordinary nut, but is definitely superior in every way. It is made from 0.40 to 0.50 carbon steel, and is forged and extruded in a forming die, then quenched and tempered. This manufacturing procedure permits the nut to develop the full strength of any stud or bolt with which it may be used.

CONTINUOUS-THREAD STUD

Here's the big reason why the Bethlehem Continuous-Thread Stud resists premature fatigue failure—there's no point of thread run-out anywhere on the stud. Therefore severe stresses cannot hit at any one point. Instead, they are effectively distributed along the stud's working length. The stud is made from carbon or alloy steels, and comes plain or heat-treated.

Bolting Trio Resists Fatigue Failure..Minimizes Down-Time

The three fasteners shown above are ideal for operations involving high temperatures or high pressures, or both. This is because of the effective battle they put up against premature fatigue failure.

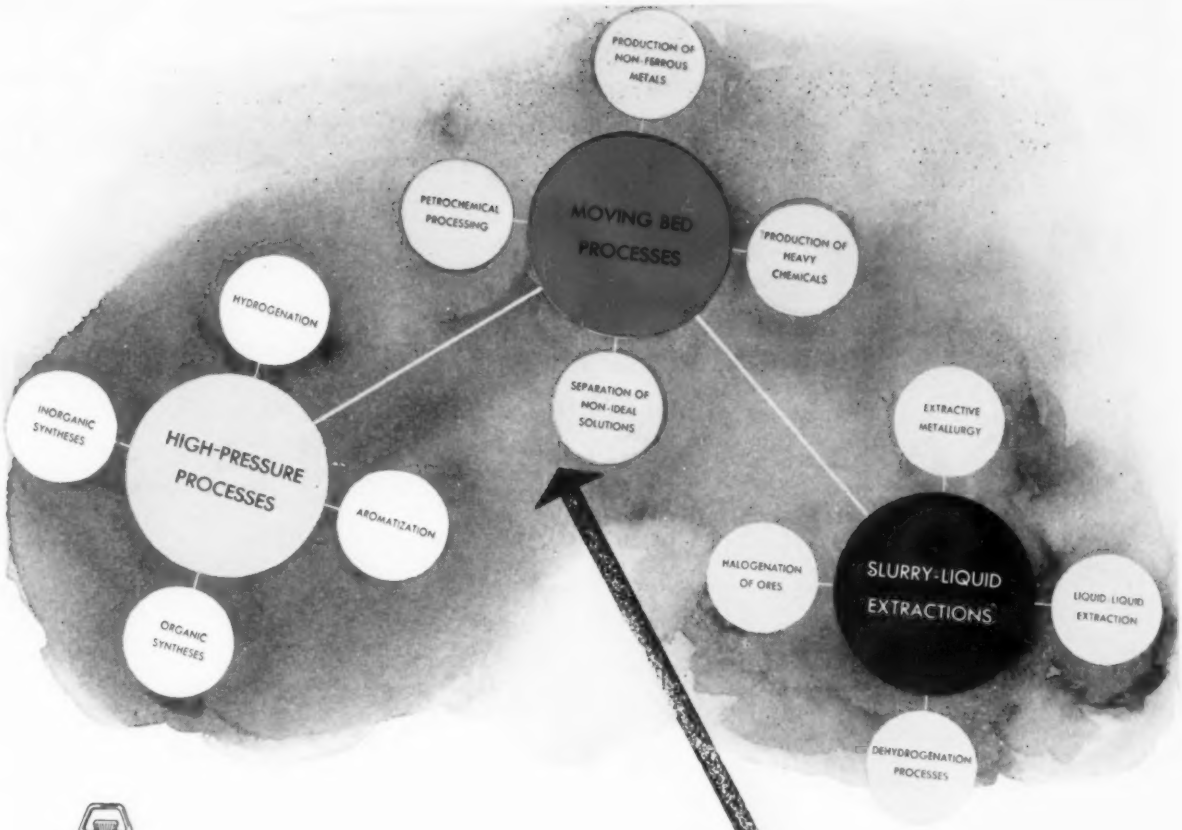
The trio, consisting of the Bethlehem Continuous-Thread Stud and two Bethlehem Quenched Nuts, have the ability to stay on the job for long periods of time. They minimize down-time, and thus effect worthwhile operating economies.

Both the Bethlehem Continuous-Thread Stud and the Quenched Nut are made in a range of sizes so wide as to meet virtually every need. If you'd like to discuss their use with a Bethlehem representative, drop a line to the nearest Bethlehem office.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

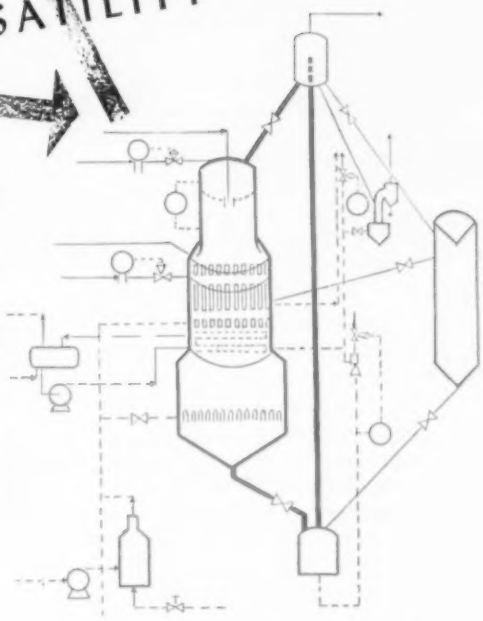


CATALYTIC CONSTRUCTION · 100% ON TIME ·

BALANCE AND VERSATILITY

One important part of Catalytic's balance and versatility is a large staff of process engineers whose broad experience is available to you in the chemical, petrochemical and petroleum industries. They can serve you as an extension of your own personnel or as a total service.

Catalytic has been instrumental in the development of many new processing techniques for the chemical industries. Among other things, our wide experience in the field of the moving bed process may help you with its new and varied applications—a versatile modern method for carrying out chemical reactions or separations. After the process design is developed, Catalytic is equipped to carry out mechanical design and to deliver and construct a facility. We welcome your inquiries.



Commercial Houdriflow catalytic cracking unit

CATALYTIC

CONSTRUCTION COMPANY

1528 WALNUT STREET, PHILADELPHIA 2, PENNSYLVANIA

In Canada: Catalytic Construction of Canada, Limited: Sarnia, Ontario

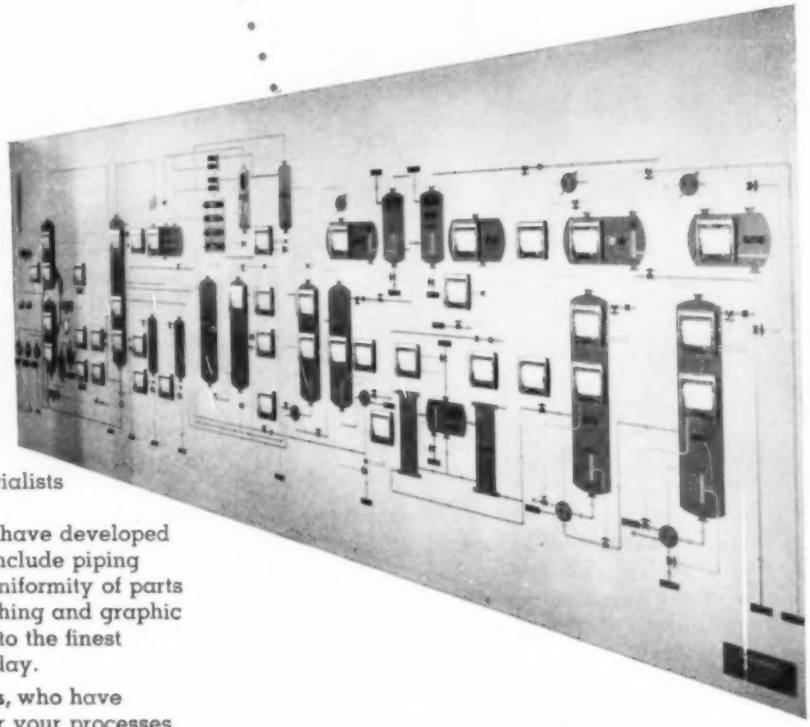
CATALYTIC *ON-TIME . . . ON-BUDGET* SERVICES for the chemical, petrochemical and oil refining industries

Project Analysis · Process Design · Economic Studies · Engineering · Procurement · Construction · Plant Operation

engineered

GRAPHIC PANELS

by FOXBORO



Working as a team, Foxboro Panel and Process Control Engineers offer you an unequalled resource . . . one which will assure you of the most efficient instrumentation, and the most practical panel layout, for your process.

Foxboro Panel Engineers are specialists in panel design and fabrication. Exclusive techniques which they have developed over many years of experience include piping arrangements, wiring methods, uniformity of parts and accessories, methods of finishing and graphic portrayal — all of which add up to the finest graphic panel work available today.

Foxboro Process Control Engineers, who have specified the right instruments for your processes over the years, are applying this valuable experience to the integrated control systems which you require today.

Whether we originate the graphic layout from your flow sheet, or work directly from a design of your own, this engineering teamwork will provide you with the ultimate in an operating panel for centralized process control.

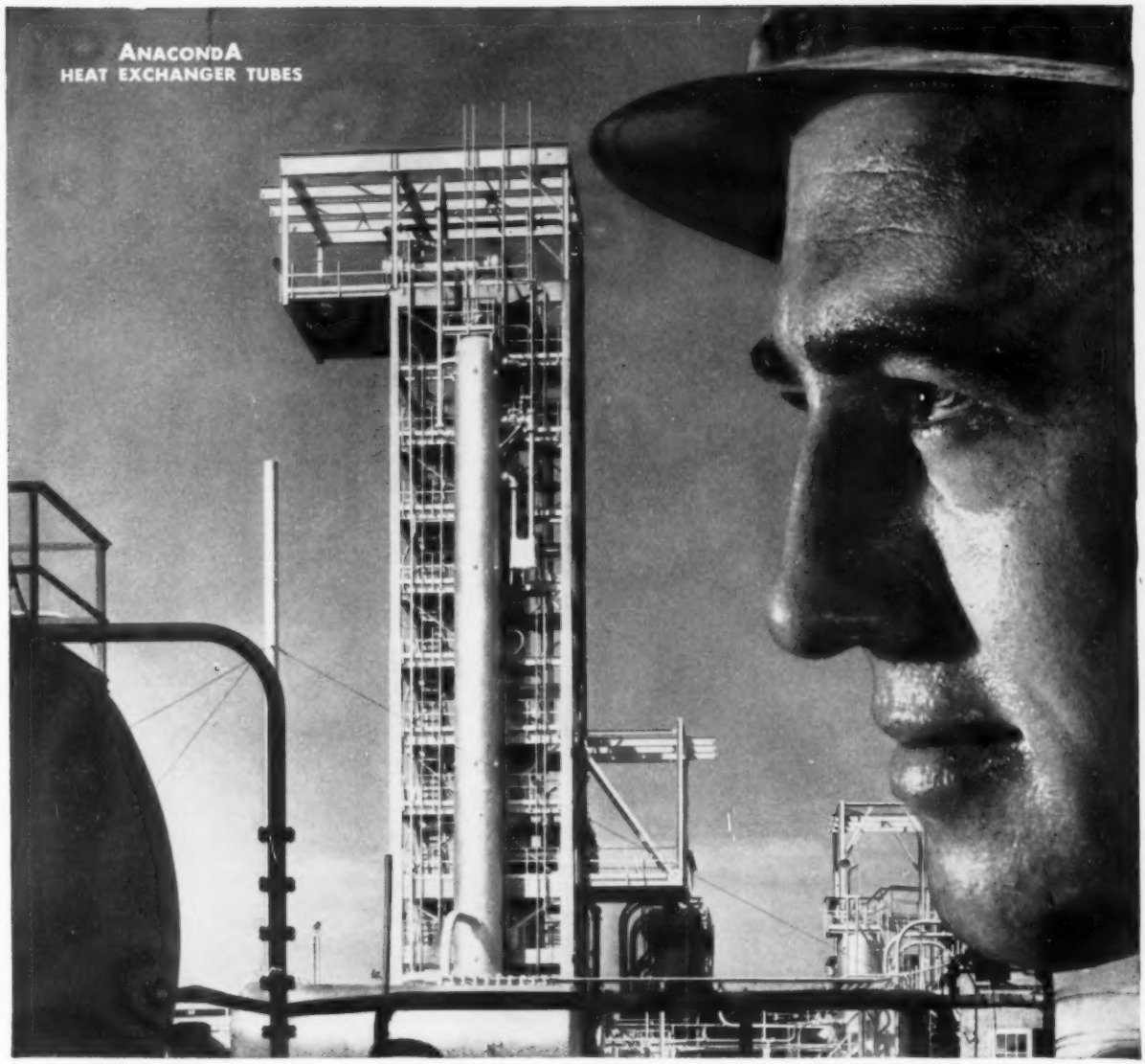
If you are planning a new or modernized control room, let us detail a proposal for you, with comprehensive data on Foxboro Graphic Panels.

The Foxboro Company, 643 Neponset Ave., Foxboro, Mass., U.S.A.

FOXBORO
REG. U. S. PAT. OFF.

PROCESS CONTROL ENGINEERING

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND



ARSENICAL ADMIRALTY-439:

OIL REFINER'S FAVORITE

WHERE oil refinery products handled by heat exchangers and condensers present no unusual problems of corrosion, high temperatures or high cooling water velocities, long experience indicates that tubes of Arsenical Admiralty-439 are the logical choice for satisfactory service life at economical cost.

This ANACONDA Tube Alloy offers good resistance to gas streams from both sweet and sour crudes and satisfactorily resists gases from sour crudes containing neutralizers. In addition, it is highly resistant to dezincification and, thus, can handle corrosive cooling waters at relatively high temperatures—a property which makes it definitely superior to non-arsenical Admiralty in most applications.

Whatever alloy best fits your operating conditions, choose it from the extensive line of ANACONDA Alloys for tubes and plate sheets. Our Technical Department's long experience in analyzing tube-performance problems is freely available to you. We have been working with copper and copper alloys for more than a century. 53113

for efficient heat transfer

ANACONDA®
Heat Exchanger Tubes

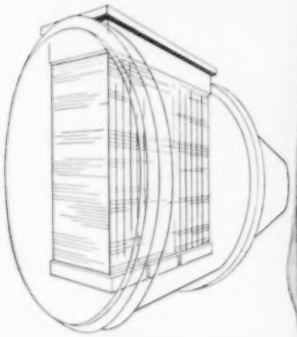
The American Brass Company, Waterbury 20, Conn.
(In Canada: Anaconda American Brass, Ltd., New Toronto, Ontario)
Send me Publication B-2 "AnacondA Tubes and Plates for Condensers and Heat Exchangers"

NAME .....
COMPANY .....
STREET .....
CITY ..... ZONE ..... STATE .....

(To obtain more data on advertised products see page 424)

A.O.Smith for

VESSELS



Sketch shows general arrangement of assembled exchanger. Tube bundle is installed through rectangular opening in the top on which tube sheet rests.

Exchanger shell, 15-feet in diameter, of welded construction, as designed and built in the A. O. Smith vessel shop.

COOLER FOR GAS

A case history of A. O. Smith design, engineering and manufacturing skill

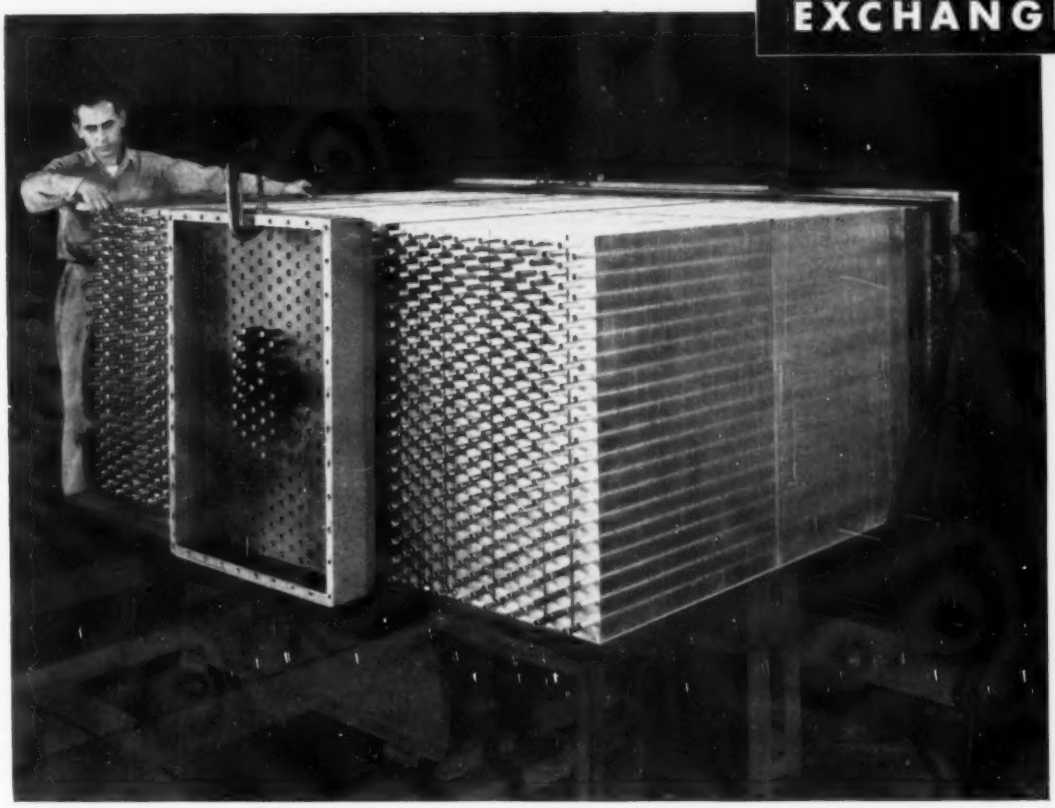
It required the combined pressure vessel and heat exchanger shops of A. O. Smith to produce this, and similar coolers, for the Gas Dynamics Facility of the Arnold Engineering Development Center at Tullahoma, Tennessee. They will cool air for a supersonic wind tunnel. Thermal capacity of this cooler is approximately 85,000,000 BTU/hr. It is designed for 140 psi on the water side, full vacuum on the air side, and to handle as much as 1,890,000 pounds of air per hour with inlet temperatures as high as 410° to 435° F.

The shell, above, is so big and tolerances so exacting that its construction required the services of a manufacturer with a proved record of diverse vesssel experience to fabricate it. It is a weldment, 15 feet in diameter. Yet, maximum out-of-round tolerance is but ¼ of wall thickness and the ends of the vessel are perpendicular to axis within −0° 10′. Clearance between baffles and the tube bundle, when installed, is held to 0.125 inch to prevent air by-pass.

Few manufacturers can take on the responsibility for such a vessel and at the same time provide the equally exacting tube bundle which it houses.

Outstanding Advantages

EXCHANGERS



Tube bundle for exchanger as designed and built in the A.O. Smith heat exchanger shop.

DYNAMICS FACILITY

The tube bundle, providing approximately 80,000 square feet of outside surface, is made up of ¾-inch tubes and aluminum fins spaced 12 to the inch, mechanically bonded to the tubes. Multiple floating heads, of A. O. Smith design, assure freedom from thermal stress, meet the extreme operating conditions in service and permit ready accessibility for replacement of a portion of the bundle or individual tubes.

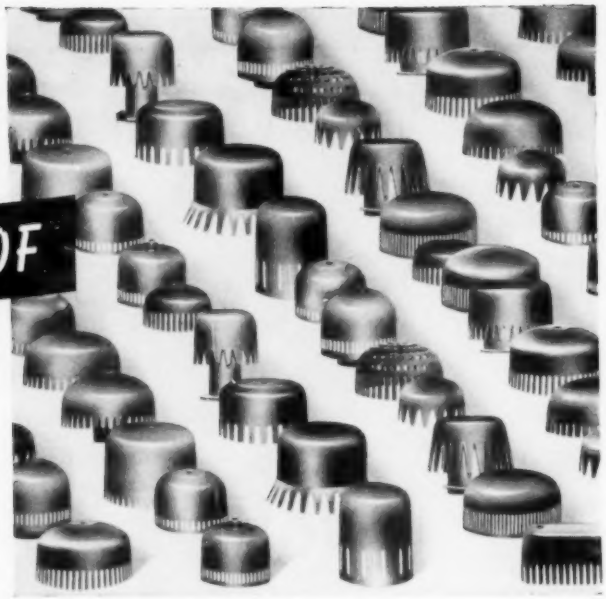
This outstanding example of vessel and exchanger fabrication in one shop reveals the capacity of A. O. Smith Corporation to satisfy your most exacting pressure vessel and heat exchanger problems. Opportunities are invited to assist in planning, designing and fabricating complete vessels and thermal transfer units. Inquiries will receive prompt and expert attention.

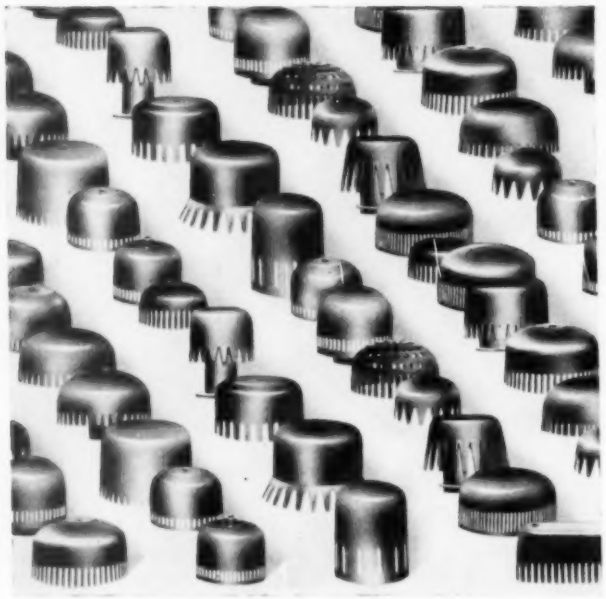
For glass-lined process equipment, contact
GLASCOTE PRODUCTS, INC.
Cleveland 17, Ohio
A new A. O. Smith subsidiary

A.O. Smith today
with faith

A.O.Smith
CORPORATION
MILWAUKEE HOUSTON LOS ANGELES
INTERNATIONAL DIVISION: Milwaukee 1, Wis.

300 STANDARD STYLES OF PSC Bubble Caps & Risers





...promptly furnished WITHOUT DIE COST

With dies on hand for over 300 standard styles of bubble caps and risers, PSC is in a position not only to save many customers the cost of dies but also to save them design and delivery time. PSC bubble caps are also effecting substantial maintenance economies, due to the fact that PSC customers can order bubble caps in the particular metal which best meets their specific heat and corrosion requirements. We fabricate caps from any metal: aluminum, brass, copper, nickel, stainless steel in any chrome-nickel or straight chrome type, as well as carbon steel.

You'll Be Days and Dollars Ahead with PSC Caps

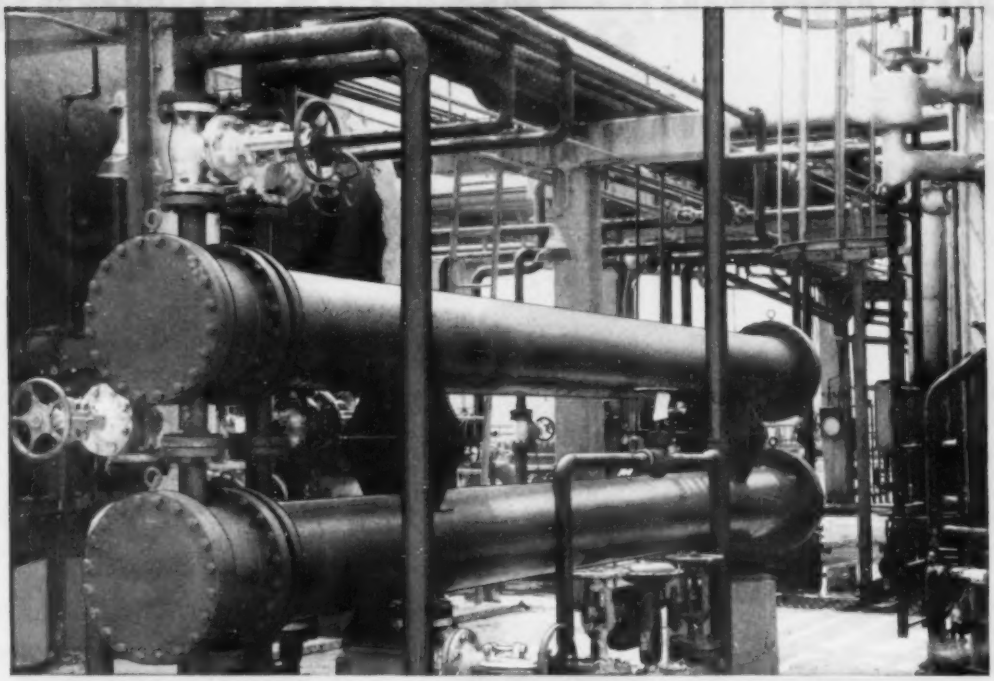
PSC catalog 52 contains, we believe, the largest compilation of engineering data on bubble caps; also drawings for use in determining methods of tray assembly. Details in catalog can be modified in almost unlimited ways to suit your needs. Special caps made to order.

——SEND FOR CATALOG 52—▷

THE PRESSED STEEL COMPANY
of WILKES-BARRE, PENNSYLVANIA

Industrial Equipment of Heat and Corrosion Resistant WEIGHT-SAVING *Sheet Alloys*

☆ ☆ ☆ OFFICES IN PRINCIPAL CITIES ☆ ☆ ☆



STRIKE IT RICHER

When you find oil, you strike it rich. When you get high processing yields from that oil, you strike it richer. ADSCO helps refineries get the most out of its crude by designing and manufacturing heat exchangers efficiently suited to their process . . .

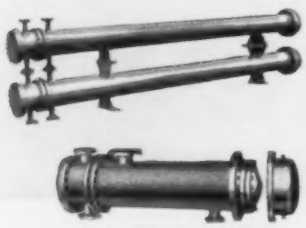
An outstanding example of ADSCO engineering is the installation shown above in a Perth Amboy, N. J., refinery. Here is a liquid-to-liquid heat exchanger consisting of two units arranged in series. The engineers specified only that one liquid was to be cooled from 190° F to 100° F, the other to be heated from 75° F to 165° F. From then on the problem was ADSCO's and ADSCO developed the most economical design in competition with several other heat exchanger manufacturers. Each of the two units has two passes on the tube side and, because of a longitudinal baffle, two passes on the shell side. This permits a counterflow design to get the maximum heat-transfer efficiency. Were it not for the counterflow design, the exchanger would have to be built in three or four units, instead of two, thus increasing the cost . . .

ADSCO cordially invites inquiries.

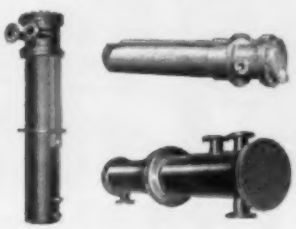
AMERICAN DISTRICT STEAM COMPANY, INC.

GENERAL OFFICES
NORTH TONAWANDA, NEW YORK
PLANTS: NORTH TONAWANDA, N. Y., AND RICHMOND, CALIF.

ADSCO ENGINEERED PRODUCTS FOR THE OIL, GAS, CHEMICAL AND POWER INDUSTRIES



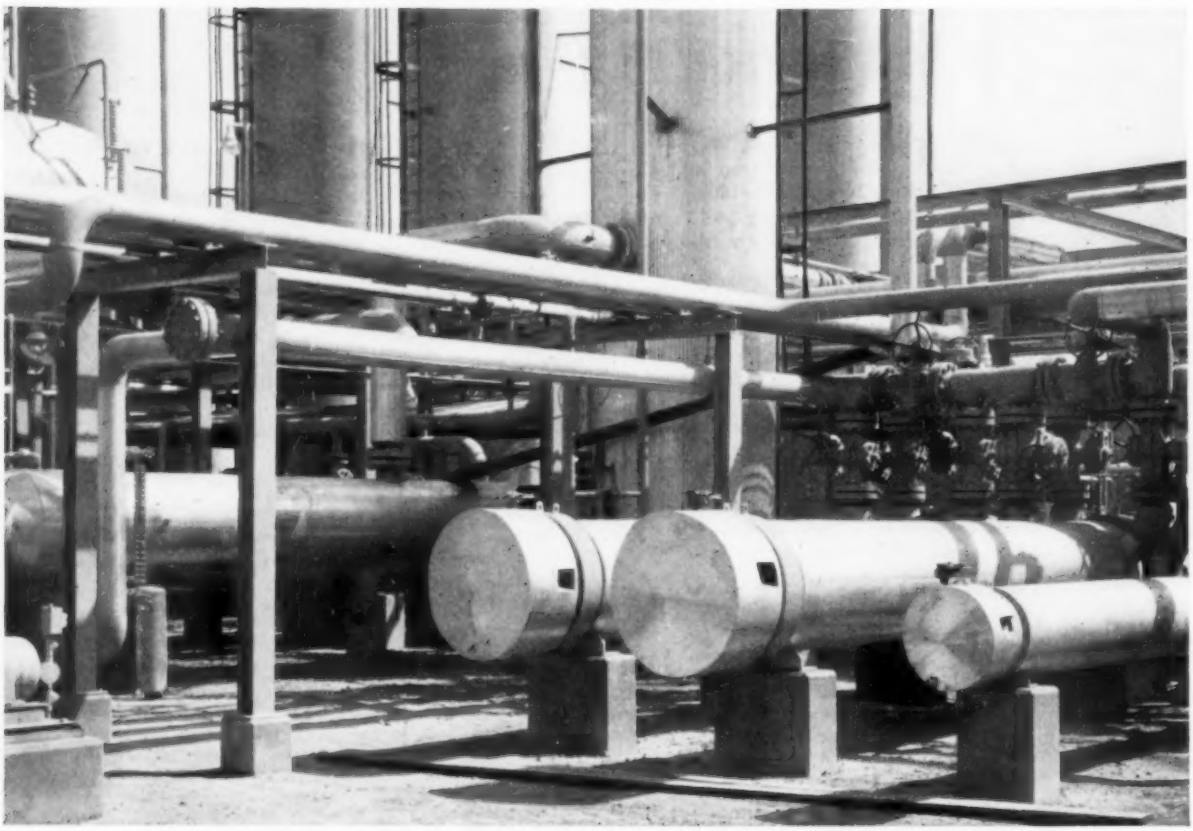
ADSCO
ENGINEERED
PRODUCTS



(To obtain more data on advertised products see page 424)

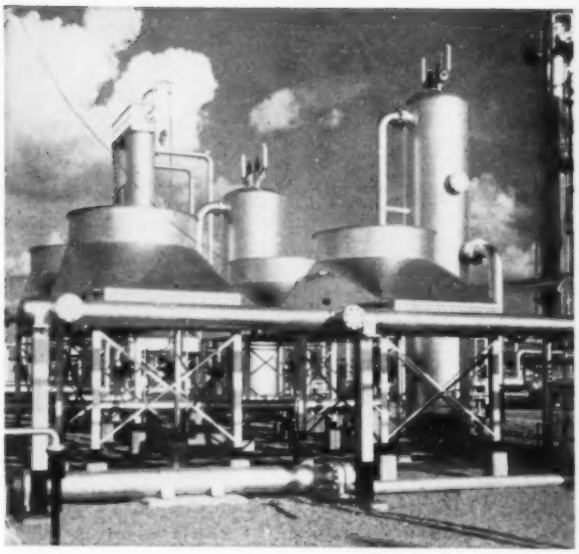
Profit-building answers to Modern

...examples of the wide variety of heavy-metal equipment designed and built by Alco to meet today's demands in petroleum and petrochemical processing . . . results of **Alco Experience** . . . gained through many years of designing and building heavy-metal equipment for refining and processing companies the world over . . . and **Alco Facilities** . . . capable of handling economically an extremely wide range of metal-fabricating operations . . . of meeting strictest customer requirements.

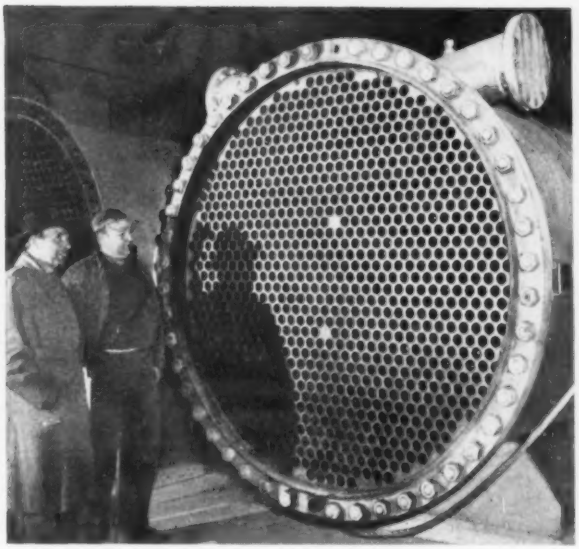


ALCO FEED EXCHANGERS AND REBOILER heat the product stream to the de-ethanizer column at Lion Oil Company's Diamond M-Sharon Ridge gasoline plant in Scurry County, Texas, "The richest county west of Fort Worth." All shell-and-tube heat-transfer equipment at this new, 50,000,000 cu ft-capacity plant is Alco built.

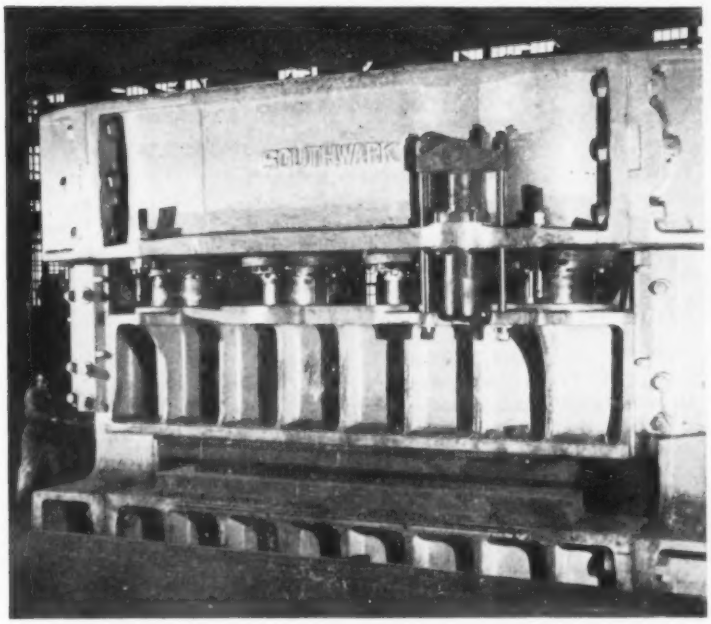
Processing problems



ALCO AIRCOOLERS help cut cooling costs at Sun Oil Company's pressure maintenance station at Allison Ranch, Texas. These modern, high-efficiency units are ideal answers to cooling problems caused by insufficient water supply or high relative humidity affecting evaporative units.



EXHAUST GAS COOLERS custom-engineered by Alco are part of the extensive facilities for testing supersonic aircraft, guided missiles and aircraft engines at the new Arnold Engineering Development Center at Tullahoma, Tenn. Also installed at the Center are 25,000 ft of Alco Steel Pipe.



SCORES OF PROFIT-BUILDING ANSWERS to modern processing problems have taken shape on this large press at Alco's 31-acre Dunkirk plant. This is just one of the many special machines that enable Alco to meet your strictest specifications—quickly and economically.

How about your own processing problems? Is heavy-duty equipment a factor? If so, contact your nearest Alco Products sales representative today—as the first step toward profit-building answers. Offices in Dunkirk, New York, Chicago, Los Angeles, Kansas City, Houston, Tulsa, and Beaumont.

ALCO
PRODUCTS

AMERICAN LOCOMOTIVE COMPANY • DUNKIRK, N. Y.

(To obtain more data on advertised products see page 424)

How to Assure Low-Cost Steel Valve Service ...in Hot Oil Handling, for example

THE INSTALLATION

In the world's largest natural gasoline and gas cycling plant at Katy, Texas, with Crane steel gate valves on absorption oil heater lines. Working pressure, 160 psi, 520 deg. F.

VALVE SERVICE RATINGS

SUITABILITY:	Fully effective
FEATURES:	Crane Exelloy Trim
MAINTENANCE COST:	Nil—routine care only
SERVICE LIFE:	10 yr. plus—prolonged life assured
OPERATING RESULT:	No shutdowns for valve trouble
AVAILABILITY:	Crane Catalog item—No. 33X

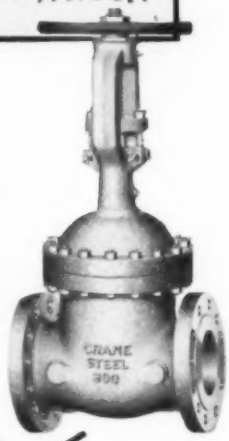
THE CASE HISTORY

Installed as original equipment, these Crane No. 33X 10-inch gate valves have given continuous service since 1943. Year after year, they remain fully effective under severe conditions. They seat tightly with smooth, positive operation, yet with no maintenance other than periodic cleanout of accumulated oil sludge. Their Crane Exelloy seating surfaces show no sign of corrosive or erosive effects. They assure the plant of continued trouble-free, low-cost performance.

Obviously, valves that behave like this aren't bought on price alone. Quality is the first consideration. That's thrifty buying—the only way to get the best value.

THE VALVE

It stands apart from ordinary performance because of pioneering skill in steel casting . . . leadership in design and manufacture . . . and complete suitability for petroleum industries' process and power service needs. Choose from the widest range of body and trim materials, in all pressure classes and sizes, with flanged, screwed, or welding ends. See your Crane Catalog or Crane Representative.



THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

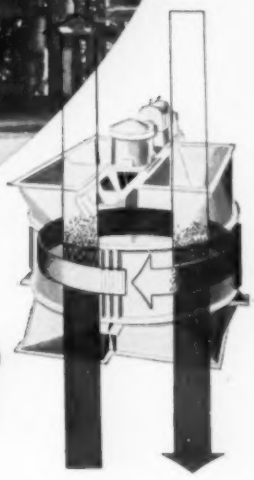
CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES · FITTINGS · PIPE · PLUMBING · HEATING

with the

Ljungstrom Air Preheater



In every processing vessel that burns fuel, air preheat shows the way to save as much as *one barrel out of every five.* When refineries alone burn over 200,000,000 barrels every year, this means the *Ljungstrom Air Preheater* can recover tens of millions of *production dollars* that are now going up the stack.

The Ljungstrom removes precious BTU's from exit gases and transfers them to combustion air. Its effectiveness can be gauged from the fact that every 35-40°F of preheat means roughly a 1% saving in fuel—and Ljungstroms now in use preheat air to over 600°F.

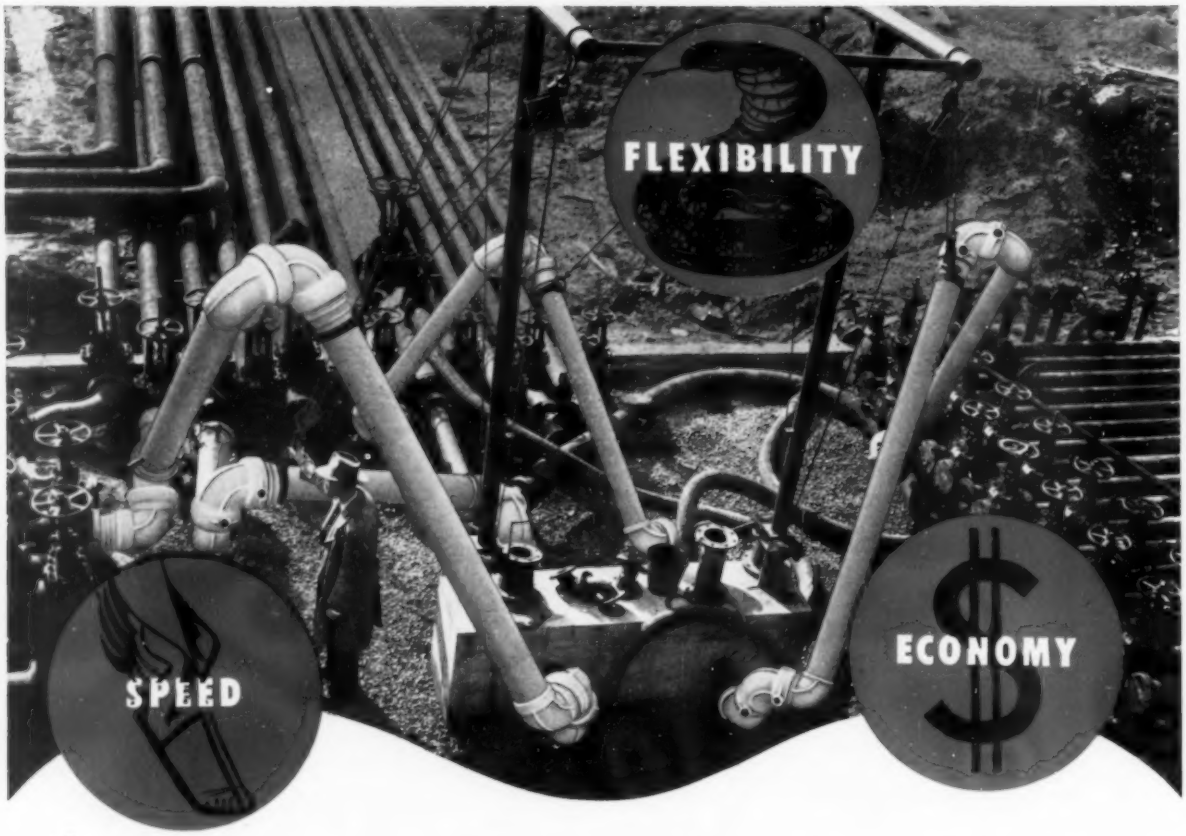
In addition to saving as much as 20% of your fuel, more effective fuel utilization means that your equipment can deliver greater throughput . . . can burn lower grade fuels with less slagging . . . lets you eliminate convection surfaces without reducing production.

In these days of high fuel costs, every process industry should consider the Ljungstrom for new installations or modernization of existing equipment. Call or write The Air Preheater Corporation for full details.

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.

Wherever You Burn Fuel, You Need Ljungstrom

THE AIR PREHEATER CORPORATION 60 East 42nd Street, New York 17, N. Y.



CHIKSAN Swivel Joints illustrated in this installation, facilitate the speedy, economical handling of various fluids through 16 lines from loading dock to manifolding pit — a distance of 800 feet. Since each line leads to a separate tank through the manifold, cross contamination is eliminated.

CHIKSAN Swivel Joints in the pump manifold above enable operator to pull base stock from outside storage into the plant and direct flow to proper vessel or proportioner.

The Flow of Enterprise Relies on

CHIKSAN

Ball-Bearing Swivel Joints

CHIKSAN Manifolding Saves 3 Ways!

- √ ORIGINAL INSTALLATION
- √ NO CONTAMINATION LOSSES
- √ LOW COST OPERATION

Original cost of CHIKSAN flexible line manifolding installations often run as much as 50% less than fixed line manifolding operations which incorporate costly multiple valve and line systems.

A CHIKSAN manifolding operation is simplified in its entirety — providing complete flexibility, mobility and ease of operation in limited spaces.

CHIKSAN manifolding installations reduce line hook-up time — keep pit floor clear of lines thereby providing greater working areas.

CHIKSAN manifolding operations facilitate the transfer of all types of fluids safely and rapidly under extreme climatic conditions with no possibility of cross contamination.

CHIKSAN manifolding installations are specifically engineered for long life — easy and economical maintenance, and render years of trouble-free operation.

Our Engineering Research and Development Department will welcome inquiries on your manifolding problems.

Write for Catalog 53-C, Dept. 3-PP

CHIKSAN

Representatives in Principal Cities

CHIKSAN COMPANY • BREA, CALIFORNIA • Chicago 28, Illinois • Newark 2, New Jersey

West Coast Engineered Mfg. Corp. (Division), Houston 2, Texas — Chiksan Export Company (Subsidiary), Brea, California — Newark 2, N. J.

CLAD STEEL CUTS CORROSION IN NEW TWIN REACTORS

This 25,000-barrel-per-day Houdriflow cat-cracker features twin reactor-kilns built into one large vessel for the first time. But designing this unit presented many problems. The reactor, for instance, had to resist corrosive action of the crude fraction at temperatures in the neighborhood of 950°F. To get *economical* corrosion resistance, stainless-clad steel was specified for the cone, shell and an internal head.

To get economical performance like this in other major units of this refinery, stainless-clad steel was specified for the atmospheric, vacuum and synthetic crude towers and for the flash fractionator to minimize corrosion, downtime and equipment failure. The light layer of cladding, inseparably bonded to the carbon or low-alloy backing steel, gives the performance of expensive solid high-alloy plate at much lower cost. Strength and rigidity are supplied by the backing plate.

Now this refinery is ready to meet increasingly competitive conditions as the result of an expansion program that raised operating efficiency and tripled throughput. While still in the planning stages, the refiner's engineers called on the equipment builder to help translate their ideas into the specialized equipment needed. His particular knowledge of fabricating techniques utilizing clad steel helped put this refinery ahead in output and profit. You, too, will find that it pays to consult your fabricator early in your planning for equipment that is lower in cost, longer lived and requires less maintenance.

Clad steel in this Houdriflow cat-cracker provides economical corrosion resistance at high temperatures

Ask one of your fabricators to show you the new Lukens clad steel movie, "Equip for New Profits." Here—in full color and sound—are factual accounts of how clad steel equipment brings new economies. The story can suggest new ideas to everyone concerned with production efficiency. Or contact Manager, Marketing Service, Lukens Steel Company, 682 Lukens Building, Coatesville, Pa.

LUKENS CLAD STEELS

STAINLESS-CLAD · NICKEL-CLAD · INCONEL-CLAD · MONEL-CLAD

PRODUCER OF THE WIDEST RANGE OF TYPES AND SIZES OF CLAD STEELS AVAILABLE ANYWHERE

(To obtain more data on advertised products see page 424)

OIC Valves

...THE MODERN LONG LINE

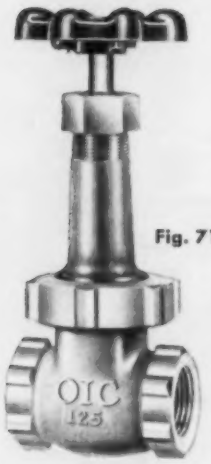


Fig. 7100

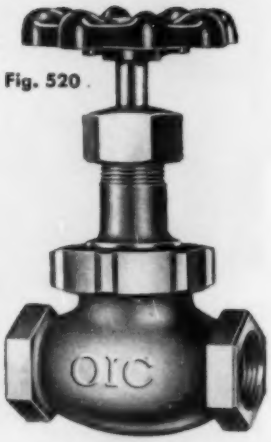


Fig. 520

BRONZE

⅛″ to 3″. 125, 150, 200, 300 and 350 WSP; 300A; 200, 400, 2,000 and 2,500 WOG.

Fig. 516

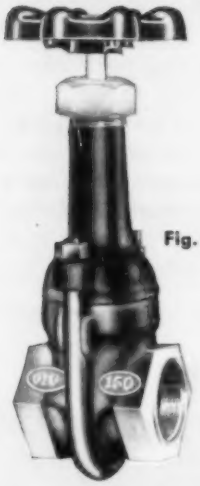


Fig. 333

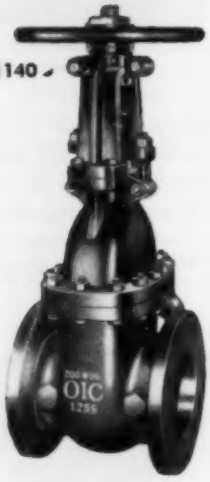


Fig. 1140

IRON

1¼″ to 16″. 125, 150 and 250 WSP; 175, 200, 400 and 500 WOG. ¼″ to 4″ DUO-BOLT Gates.

Fig. 124

(To obtain more data on advertised products see page 424)

CAST STEEL

2″ to 16″. 150, 300 and 600 lb. primary pressure series.

Fig. 6033

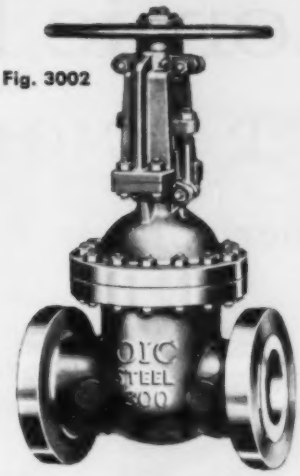


Fig. 3002

Fig. 1572

FORGED STEEL

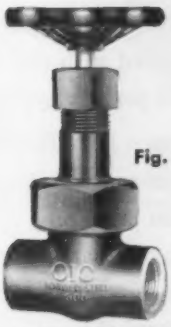


Fig. 1021

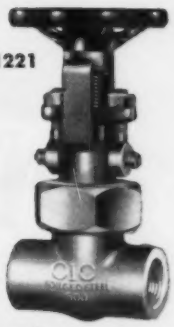


Fig. 1221

¼″ to 2″ Gate, Globe, Angle, Check Valves; 600 lb. primary pressure series.

STAINLESS STEEL

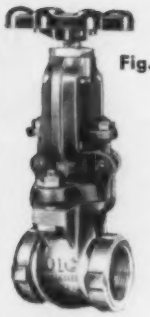


Fig. 810

½″ to 2″. Gate valves, 200 lb. primary pressure series.

Fig. 815

LUBRICATED PLUG

Fig. 10

1″ to 24″. Iron . . . 175 psi to 800 psi working pressures. Cast Steel series 150 lb.-230 psi, 300 lb.-600 psi and ASA 150 lb. class.

Contact your authorized OIC Distributor

OIC
FOUNDED 1883

Write for the OIC Catalog Digest for quick valve selection.

THE OHIO INJECTOR COMPANY

WADSWORTH, OHIO

From Atomic Research

COMES FASTER... MORE ACCURATE

measurement of percentage hydrogen in liquid hydrocarbons . . . . . .

Here is an instrument that utilizes the absorption of beta rays as a means of measuring the percentage of hydrogen, or the hydrogen-carbon ratio, in liquid hydrocarbons. Now . . . for the first time . . . research men, product control engineers, and others can obtain a quick, accurate determination in five minutes instead of the four hours required by combustion train methods. Furthermore the measurement is made with an accuracy of 0.02 weight percent hydrogen as compared with the usual 0.05 weight percent hydrogen.

The new Cenco Beta Ray H/C Meter has numerous applications in petroleum processing . . . in refining operations where the hydrogen-carbon ratio is altered . . . where the percentage of hydrogen is an index to the performance of end products, as fuel oils, jet fuels, gasolines, etc. Full details about this modern precision instrument are contained in our Bulletin No. 115. Write for your copy today. Exclusive manufacturing and sales rights for the Cenco Ray H/C Meter have been assigned to Central Scientific Company by Standard Oil Company (Indiana).

The NEW cenco® Beta Ray H/C Meter

utilizes radioisotopes

Our 14 branch offices and warehouses assure prompt service and shipment of laboratory apparatus and supplies.

cenco

The most complete line of scientific instruments and laboratory supplies in the world

R.S.C. TULSA

CENTRAL SCIENTIFIC COMPANY

MAIN OFFICE — PLANT — CENCO INTERNATIONAL CIA.
1700 IRVING PARK ROAD • CHICAGO 13, ILLINOIS

BRANCHES AND OFFICES — CHICAGO NEWARK BOSTON WASHINGTON DETROIT SAN FRANCISCO SANTA CLARA LOS ANGELES

CENTRAL SCIENTIFIC CO. OF CANADA, LTD. (and Hendry Division)
TORONTO MONTREAL VANCOUVER OTTAWA

REFINERY SUPPLY COMPANY — TULSA HOUSTON

(To obtain more data on advertised products see page 424)

Caps are part of the story

The announcement of the WeldELL line, back in 1931, created a considerable sensation in the piping field. Pipe welding was then just beginning to emerge from the crude, cut-fit-patch stage and the only welding fittings then in use were simply elbows.

But here was a *full line* of welding fittings—not only the long and short radius ells, but also full branch and reducing tees, concentric and eccentric reducers, stub ends, welding neck flanges . . . even *caps!*

You know what happened: The WeldELL line had taken pipe welding out of darkness into light . . . had provided the impetus and set the pattern of modern pipe welding practice.

Yes, the WeldELL line was the first complete line—the first engineered line . . . and the fittings that showed the way are still showing the way. For up-to-the-minute facts about the WeldELL line see your Taylor Forge Distributor.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS

General Offices and Works: P. O. Box 485, Chicago 90, Illinois

Offices in all principal cities • Plants at: Carnegie, Pa.; Fontana, Calif.; Gary, Ind.; Hamilton, Ont., Can.

(To obtain more data on advertised products see page 424)

YOU CAN ELIMINATE COST
OF THIS EXTRA WATER PIPING
(dotted lines)
Cooling Water In
Bearing Bracket
Bearing Bracket
Turbine Casing
Cooling Water Out
WITH G-E TYPE DP MECHANICAL-DRIVE TURBINE (All oil cooled in single reservoir)
OIL COOLER
Cooling Water Out
Cooling Water In
Pipe cooling water into single oil cooler only—this feature of G.E.'s Type DP turbine saves time and extra piping costs in turbine installation.

ANOTHER PLUS VALUE OF G-E MECHANICAL-DRIVE TURBINES...

Single Oil Cooler Saves Extra Turbine Piping Costs

You save on installation costs with a G-E mechanical-drive turbine because General Electric pipes the bearing oil back to a single reservoir for cooling, in a single oil cooler. This eliminates the extra costs of running cooling water piping to and between each bearing. This feature alone can save you up to $50.00.

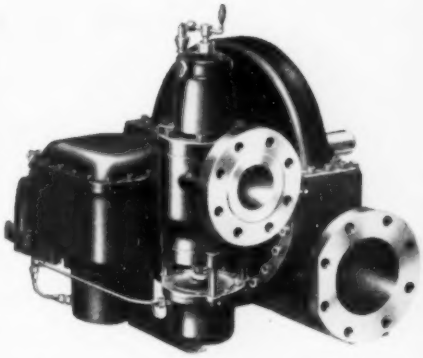
This single oil cooler is just one of the many features on the Type DP turbine which save you money. The chart below indicates other areas of savings.

Remember—the total cost is often more than just the sales price. But G.E.'s standard DP turbines include the extra features that save you extra costs. For more information contact your nearest G-E Apparatus Sales office. Write for bulletin GEA-4955A, "A New Standard in Mechanical-drive Turbines." General Electric Company, Schenectady 5, N. Y. 257-64

GENERAL ELECTRIC

INSTALLATION AND MAINTENANCE COST-SAVING FEATURES

THESE EXTRA FEATURES, STANDARD ON ALL G-E TYPE DP TURBINES, CAN . . .	Save You up to
COMBINED TRIP-THROTTLE VALVE Eliminate extra cost of buying and installing valve ahead of the turbine.	$200.00
SINGLE RESERVOIR FOR COOLING LUBE OIL Eliminate extra cost of piping cooling water to and between bearings.	50.00
MAJORITY OF PARTS INTERCHANGEABLE One set of spare parts protects several units—less money tied up in inventory.	100.00
METALLIC-LABYRINTH VALVE STEM BUSHING Eliminate labor costs of replacing soft packings; cut down-time production losses.	50.00
SHAFT MONEL-SPRAYED AT PACKING FIT Saves frequent cost of purchasing and installing carbon rings; contributes to long shaft and packing life.	20.00
ESTIMATED TOTAL SAVINGS	$420.00



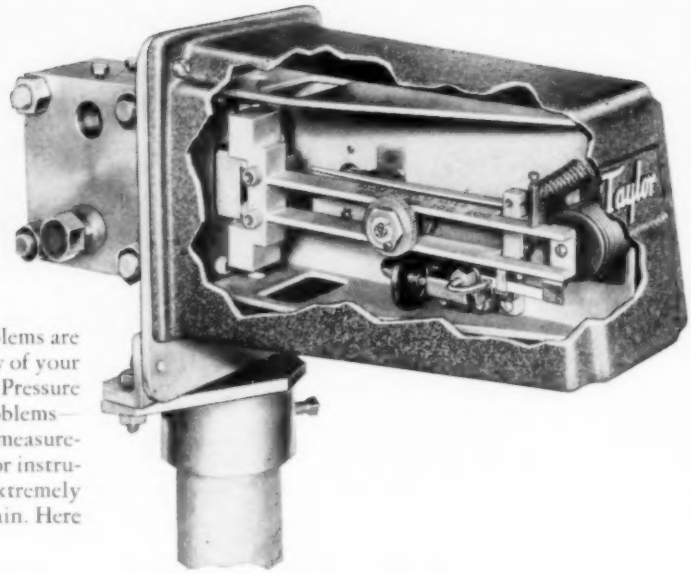
G-E Type DP Mechanical-drive Turbine

COMPARE THE FEATURES
EVALUATE ALL THE COSTS

See why G-E standard Type DP turbines are your most economical buy.

A FLOW TRANSMITTER

That relieves half your headaches



BECAUSE about 50% of your instrument problems are flow problems, here is a fine remedy for many of your headaches. The Taylor TRANSAIRE* Differential Pressure Transmitter is a specific for most of your flow problems—and many others requiring differential pressure measurement and transmission. This relatively new Taylor instrument has already proved itself in the field to be extremely accurate, simple to install, and very easy to maintain. Here are some of its more important features:

Inexpensive and Simple to Install

1. Simplified piping because it can be close-coupled to orifice flanges.
2. No Leveling—mercuryless dry meter.
3. Side, top or bottom bracket mounting available with 2" pipe stand.
4. No seal pots required—Negligible displacement because of force balance construction.
5. Light weight for easy handling; weighs only 23 lbs.
6. Vent screws for simple, solid filling.

Economical—Easy to Maintain

7. Self draining or venting—no periodic manual venting or draining.
8. Mercuryless—flexible but tough Teflon coated glass fabric diaphragm.
9. Over-range to full body rating with no permanent damage.
10. Purges, if required, can be installed to keep body swept clean.
11. Simple range change by sliding pivot—screw driver trim.

Accurate

12. Relay valve for linearity, minimum hysteresis, fast speed of response.
13. Pressure effect 0.2% / 100 psi.
14. Temperature effect 1.0% / 100°F.
15. Self draining and venting. No errors build up during operation.
16. Hydraulic damping—assures stable air output even on vibrating pipe lines.

Rugged and Dependable

17. Body forged steel or types 430 and 316 Stainless Steel. Working pressure rating, 1500 psi.
18. Weather-proof housing built for tough service and outdoor mounting. Case is self-purging.
19. Force-balance construction — negligible motion — minimum possible wear.
20. Process sealing bellows 3-ply type 316 stainless steel.

Adaptable

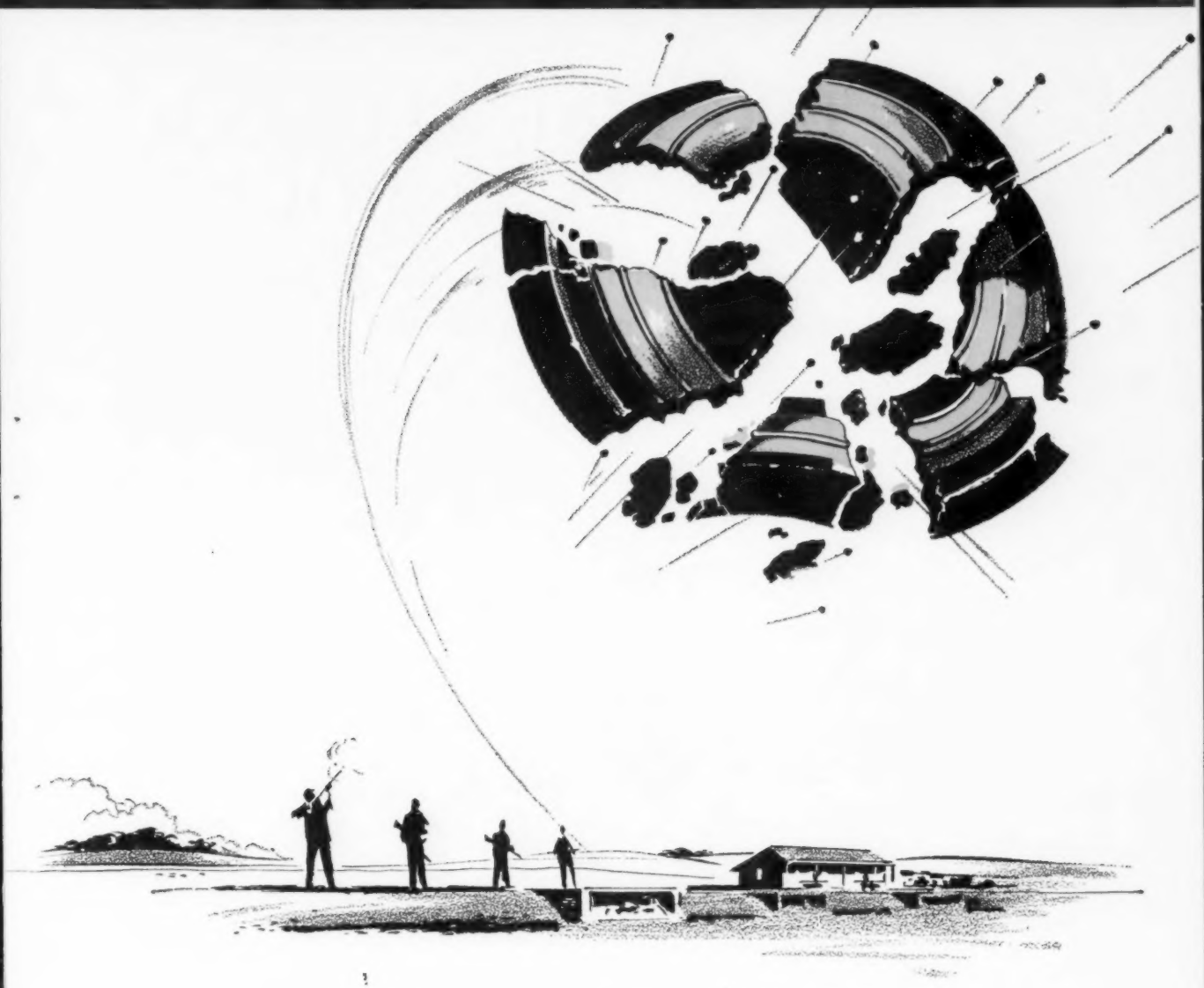
21. 100% suppression—continuously adjustable from 0 to 100%. Ideal for liquid level applications.
22. Ten-to-one rangeability in each of 2 forms:
    a. 20-200" water, b. 80-800" water.
23. Side, top or bottom bracket mounting available.

Find out more about this latest addition to Taylor's three-part TRANSET* System. Ask your Taylor Field Engineer, or write for **Bulletin No. 98226.** Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

*Reg. U.S. Pat. Off.

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY



LUCK . . . . OR SKILL?

YOU can't tell from one shot. An expert marksman earns his rating by *repeated* hits. Here at McKee we have earned our reputation for doing a good job by repeatedly ***doing a good job.***

McKee services mean correct design, sound engineering, expeditious purchasing and efficient construction . . . in short, a plant that's designed and built to earn a profit.

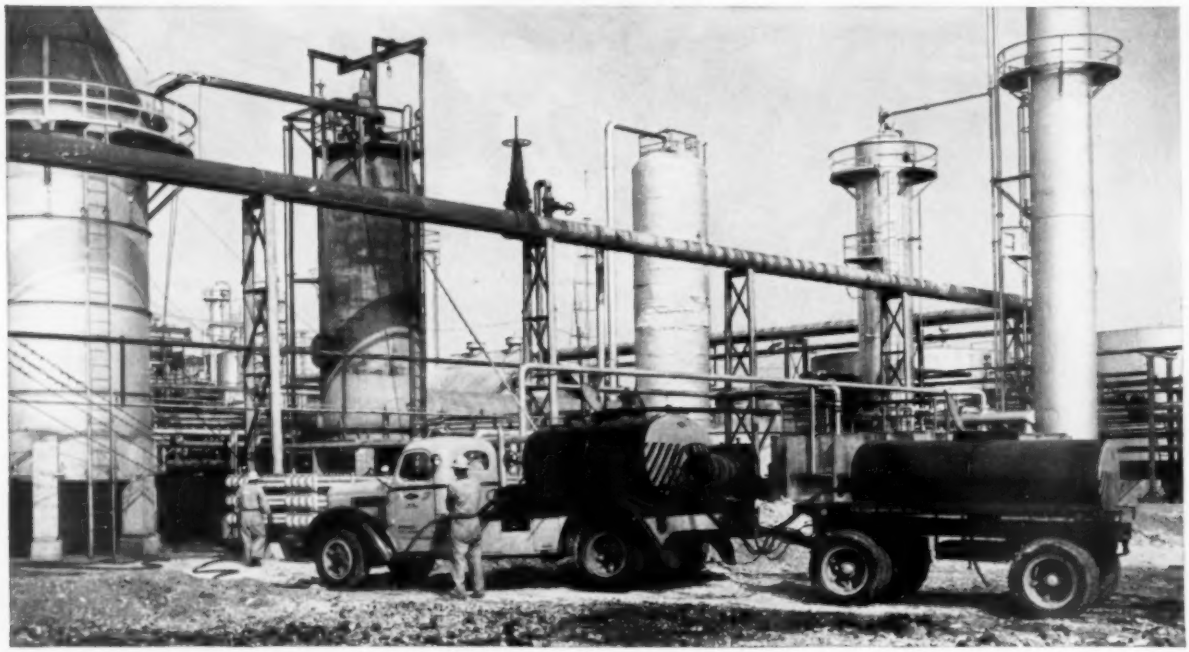
McKee Engineering Services

Arthur G. McKee & Company • Engineers and Contractors

Headquarters: McKee Building • 2300 Chester Avenue • Cleveland 1, Ohio
Offices: New York • Tulsa, Oklahoma • Union, N. J. • Washington, D. C.
British Representatives of Metals Division: Head, Wrightson & Co., Limited
Canada: Arthur G. McKee & Company of Canada, Ltd., 350 Bay St., Toronto

5-MILE LPG LINE CLEANED BY DOWELL IN 12 HOURS

Chemical cleaning restored 200 pounds of pressure lost through scale-choked butane line



A pressure drop of about 200 pounds, due to scale accumulation in a butane line, was increasing pumping costs. The 2½-inch buried line carries butane from a refinery to a butadiene plant five miles away. Dowell Service cleaned the line in 12 hours—*without dismantling or digging*. The results: original discharge pressure was restored . . . the line was metal-clean . . . the workload on equipment handling the butane was lessened, netting the operator a considerable saving.

Dowell engineers took specially prepared solvents in truck-mounted tanks right to the job. They applied the chemicals through regular connections using Dowell-designed equipment, which includes all necessary pumps and control devices.

This is but one example. There are countless others where Dowell provided the practical solution to tricky maintenance cleaning problems. Dowell Service is designed to clean process lines, heat exchangers, tanks and many other pieces of industrial equipment. No special scaffolding is required. Dismantling and downtime are kept to a minimum.

Solvents are applied by Dowell engineers according to the techniques demanded by the job—jetting, filling, spraying, cascading or vaporizing. These liquid chemicals go wherever steam and water flow, reaching surfaces inaccessible to other methods.

You can discuss your cleaning problems fully, simply by calling a Dowell engineer. He will be happy to make cost estimates—no obligation, of course. For more facts about Dowell Service, call your nearest Dowell office. Or, if you prefer, write directly to Tulsa, Dept. C-32.

DOWELL SERVICE

Over 130 Offices to Serve You with Chemical Cleaning for:

Boilers • Condensers • Heat Exchangers • Cooling Systems
Pipe Lines • Piping System • Gas Washers • Process Towers
Process Equipment • Evaporators • Filter Beds • Tanks

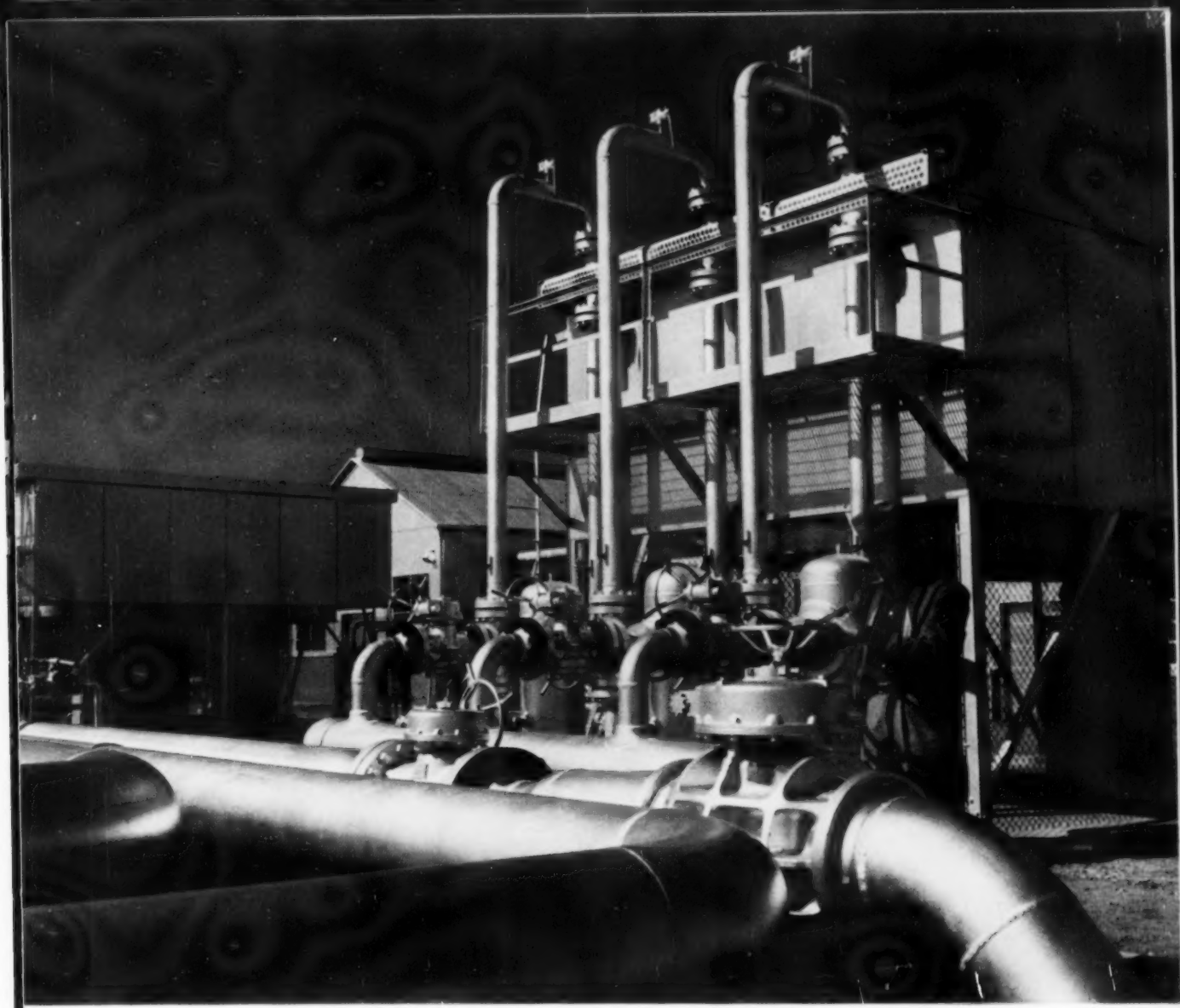
Chemical Services for Oil, Gas and Water Wells

DOWELL INCORPORATED • TULSA 1, OKLAHOMA

DOWELL

A Service Subsidiary of
THE DOW CHEMICAL COMPANY

(To obtain more data on advertised products see page 424)



CONSTANT CONTROL FOR CONTINUOUS PROCESSES

Ever notice how many Rockwell-Nordstrom valves you see at key points in continuous operation processes—where failure of one valve can shut down an entire plant? There's a sound reason for that: Nordstrom valves have a reputation for *not* failing.

If it's wise to use Nordstrom valves in *tough* spots—in lines that must operate 24 hours a day, 365 days a year, year in, year out—doesn't it stand to reason they'll give better service in almost *any* spot?

Nordstrom's first costs are comparable to other valves. In the long run, they're invariably the best buy. There's no substitute for Rockwell experience. Use it to save money on valves. *Rockwell Manufacturing Company, Pittsburgh 8, Pa.*

THREE WAYS
THE NORDSTROM LUBRICANT WORKS

Lubricant surrounds each valve port with a vapor tight pressurized seal. **Nordstrom valves stay tight.**

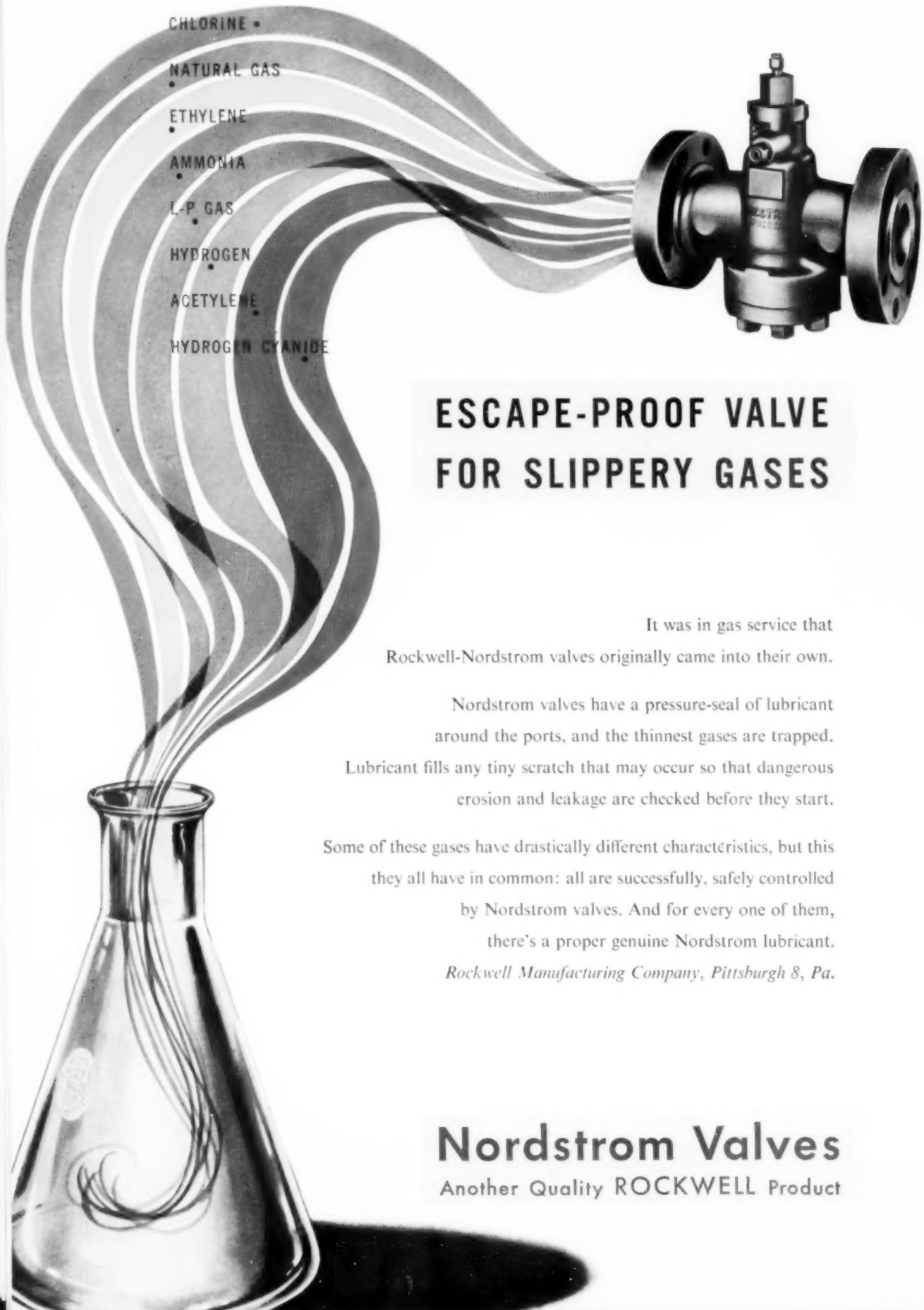
Lubricant acts as hydraulic jack—a fast quarter-turn to open or close. **Nordstrom valves operate quickly.**

Lubricant coats the plug for sliding action—no wear-producing wedging. **Nordstrom valves operate easily.**

Rockwell Built

NORDSTROM VALVES

Lubricant-Sealed for Positive Shut-Off



ESCAPE-PROOF VALVE FOR SLIPPERY GASES

It was in gas service that Rockwell-Nordstrom valves originally came into their own.

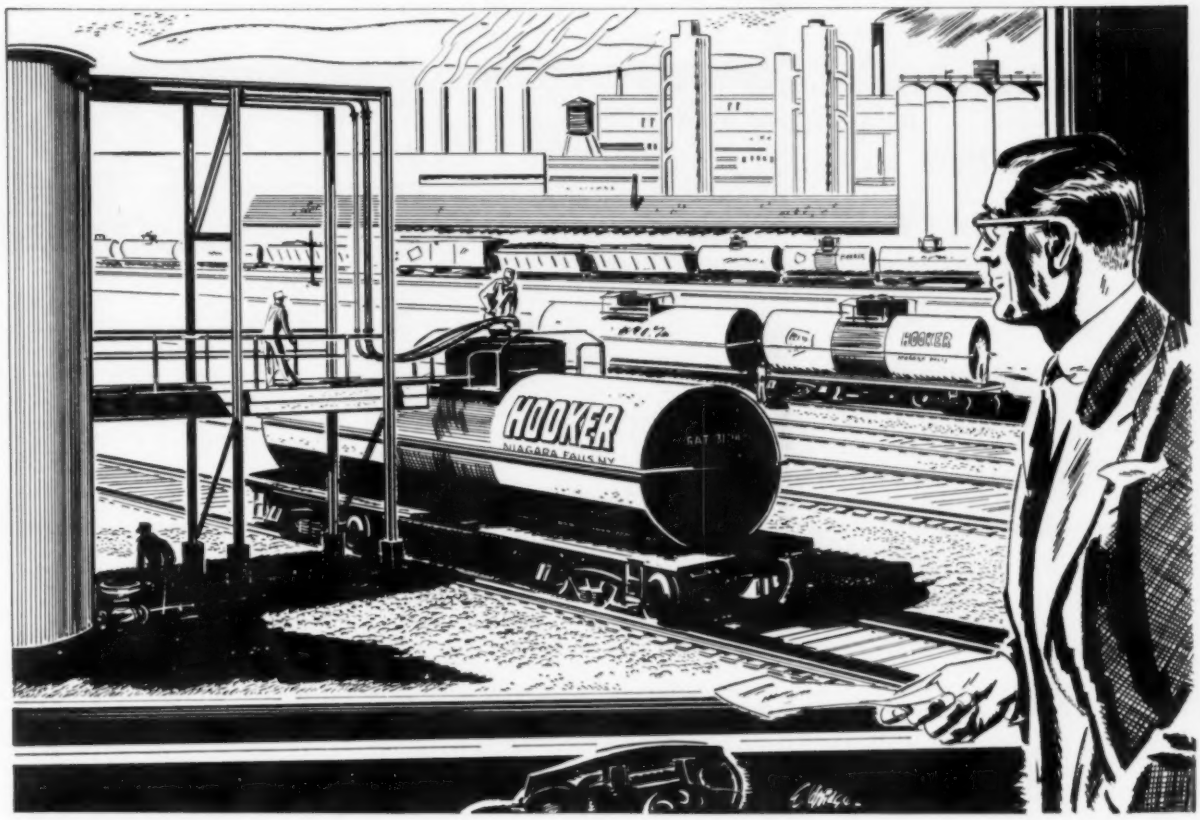
Nordstrom valves have a pressure-seal of lubricant around the ports, and the thinnest gases are trapped. Lubricant fills any tiny scratch that may occur so that dangerous erosion and leakage are checked before they start.

Some of these gases have drastically different characteristics, but this they all have in common: all are successfully, safely controlled by Nordstrom valves. And for every one of them, there's a proper genuine Nordstrom lubricant.

Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Nordstrom Valves

Another Quality ROCKWELL Product



For smoother, better processing—
buy the Uniformity Hooker Caustic Soda gives you

Month after month, year after year—you can standardize processing methods, and get consistent results, when you use Hooker Caustic Soda.

You need never adjust your process to meet variations in caustic soda shipments. You can be sure each new shipment closely matches your current inventory.

Uniformity, from shipment to shipment, is the result of close quality checking at Hooker. More than a score of inspections and analyses safeguard the uniformity of the Hooker caustic you buy.

Do you agree, with leading companies in 30 different industries, that this is a good reason to *standardize* on Hooker caustic soda?

If you do, a letter or a phone call to the nearest Hooker plant or office will quickly bring you the product data and other facts you need to make your decision.

You can *standardize* on Hooker Caustic Soda

Forms: Liquid 50% and 73% • Flake • Solid • Special fine flakes

Containers: Tank cars • Tank wagons • Barges • Drums

For fast service, phone:

CHICAGO	CEntral 6-1311
LOS ANGELES	NEvada 6-3826
NEW YORK	MUrray Hill 2-2500
NIAGARA FALLS	6655
TACOMA	Broadway 1215

HOOKER CHEMICALS

From the Salt of the Earth

HOOKER ELECTROCHEMICAL COMPANY

HOOKER ELECTROCHEMICAL COMPANY
4313 Buffalo Ave., Niagara Falls, N. Y.

Please send ☐ data sheets on Hooker Caustic Soda; ☐ Bulletin 100 describing Hooker products and services.

Name..... Title.....

Company.....

Address.....

City..... Zone..... State.....

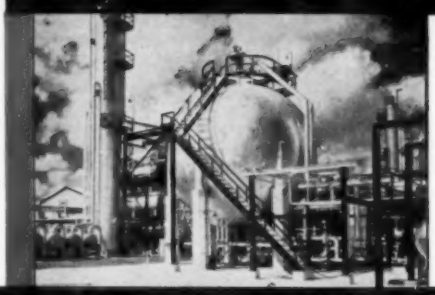
(To obtain more data on advertised products see page 424)

TO INCREASE REFINING EFFICIENCY

PETRECO

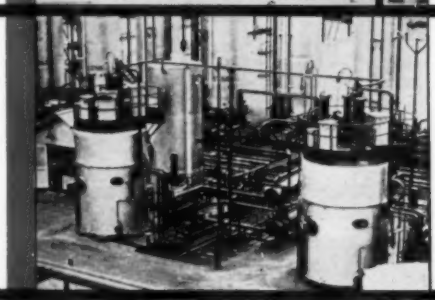
ELECTRIC PROCESSING

DESALTING



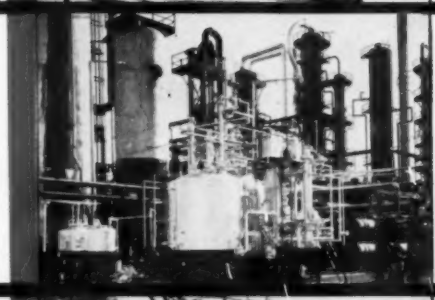
Petreco *Electric* Desalting eliminates salts, solids, and other impurities with such a high degree of efficiency that salt difficulties are eliminated – *enabling refiners to run more crude.*

LUBE OIL TREATING



Petreco Lube Oil Treating is an automatic, continuous method for acid-treating lube oils and similar stocks. It is carried on in a closed system, under pressure. High efficiency acid contacting results in minimum acid usage, negligible oil entrainment in sludge, and maximum product quality.

DISTILLATE TREATING



Petreco *Electric* Distillate Treating takes the guesswork out of distillate treating. It is applicable to acid, alkali or doctor treating all distillate stocks. It permits continuous, automatically controlled treating with minimum equipment, handling and attention.

DESAPONIFICATION

Where caustic is added to crude prior to distillation, ash-forming materials resulting from such caustic are often present in fuel stocks. Petreco *Electric* Desaponification removes about 85% of such ash-forming constituents, enabling fuel stock to be marketed or used as a cracking charge.

For complete information, call or write

PETROLITE CORPORATION

PETRECO DIVISION

3202 South Wayside Drive, Houston 1, Texas

1390 E. Burnett Street, Long Beach 6, California

PC 53-3

PETRECO

ELECTRIC PETROLEUM PROCESSING

CRUDE OILS: REMOVAL OF SALTS, SOLIDS, OTHER IMPURITIES; DEHYDRATING

LUBE OILS: CONTINUOUS, AUTOMATIC ACID-TREATING

DISTILLATES: ACID TREATING; CAUSTIC TREATING; DOCTOR TREATING

FUEL OILS: DESAPONIFICATION, ASH REMOVAL

HARSHAW

HARSHAW
makes
catalysts
to your
specifications

- SPHERICAL
- GRANULAR
- TABLETED
- POWDERED
- EXTRUDED
- RASCHIG RINGS

Harshaw manufactures to specification dozens of catalysts for many different and complex manufacturing processes. The experience of more than fifteen years in helping to solve a great number of individual catalyst problems places us in a most helpful position, either in the development of the best and most economical catalyst, or in qualifying with large production capacity requirements. If you have a problem, perhaps a discussion with us will prove helpful.

PROCESS

Hydroforming — Dehydration
Dehydrogenation — Isomerization
Alkylation — Oxidation
Cyclization — Desulphurization
Hydrogenation

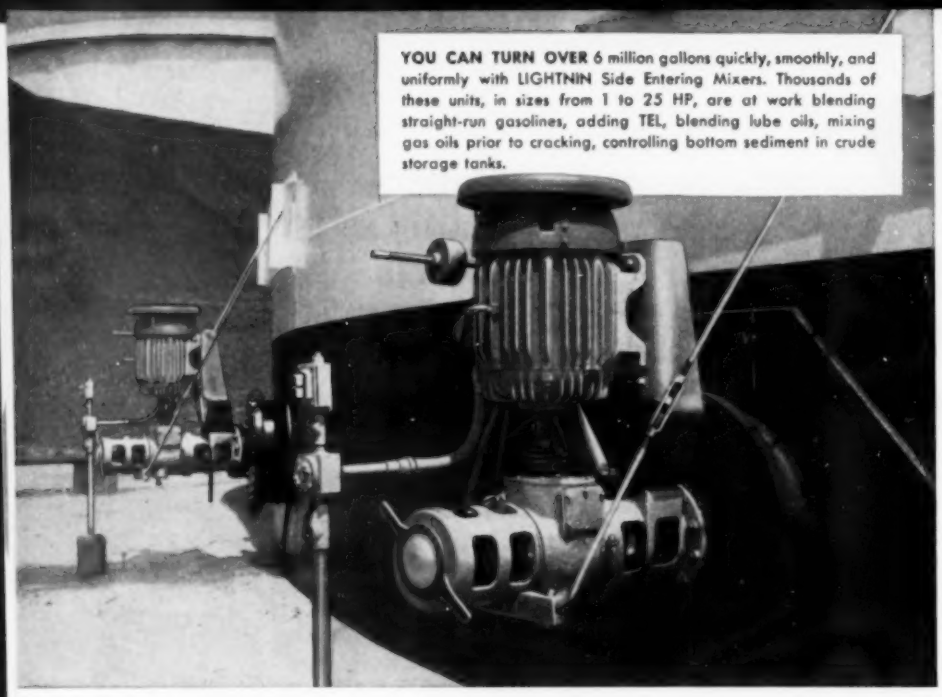
TYPICAL CATALYSTS

Aluminum Chloride Anhydrous
Boron Fluoride Addition Compounds
Boron Trifluoride
Hydrofluoric Acid Anhydrous
Alumina — Chrome Alumina
Molybdena Alumina — Tungsten Alumina
Cobalt — Copper
Mercury — Magnesia
Vanadium — Nickel

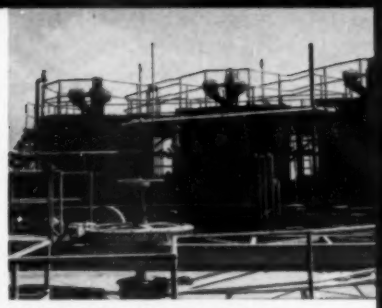
SEND FOR *this 8-page booklet on Harshaw Catalysts*

THE HARSHAW CHEMICAL CO.
1945 East 97th Street, Cleveland 6, Ohio
BRANCHES IN PRINCIPAL CITIES

SALES OFFICES and WAREHOUSES Chicago 10, Illinois, 505 North LaSalle St. • Cincinnati 13, Ohio, 6265 Wiehe Rd. • Detroit 28, Michigan, 9240 Hubbell Ave. Houston 11, Texas, 6622 Supply Row • Los Angeles 22, California, 3237 S. Garfield Ave. • New York 17, N. Y., 420 Lexington Ave. Philadelphia 48, Pennsylvania, Jackson & Swanson Sts. • Pittsburgh 22, Pennsylvania, 505 Bessemer Bldg., 6th & Duquesne Way.

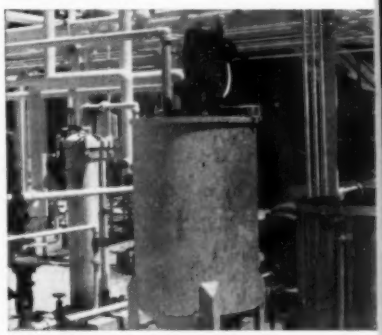


YOU CAN TURN OVER 6 million gallons quickly, smoothly, and uniformly with LIGHTNIN Side Entering Mixers. Thousands of these units, in sizes from 1 to 25 HP, are at work blending straight-run gasolines, adding TEL, blending lube oils, mixing gas oils prior to cracking, controlling bottom sediment in crude storage tanks.



CAUSTIC TREATING and other mixing jobs become fast, efficient operation with turbine-type LIGHTNIN Mixers. You can mix, blend, suspend solids, get intimate gas-liquid and liquid-liquid contact, in open tanks or closed pressure vessels with these units. Standard sizes from 1 to 500 HP provide hundreds of power-speed combinations.

FOR TANKS up to 3,000 gals., continuous or batch mixing, pipeline mixing, there are 30 LIGHTNIN propeller-type models to choose from. Sizes ¼ to 3 HP.



OPEN TANK becomes an efficient mixing vessel when you add a LIGHTNIN Portable Mixer. Over 30 models, electric or air driven. Sizes ⅛ to 3 HP.

How to be on safe ground when you plan for fluid mixing

A refinery engineer recently found he had been allowing two hours for a mixing operation that, when correctly done, took 15 minutes.

Why take chances with fluid mixing—when it's so easy to *be sure* you're right?

You can get the right data-answer for *any* fluid mixing problem—quickly, without cost or obligation—by handing the problem to your LIGHTNIN Mixer representative.

He eliminates guesswork and risk, by giving you an unqualified guarantee of *successful results.*

His approach to your problem is sound, fundamental—yet fully in step with today's processing methods.

His recommendations are based on 25 years of research and field experience on thousands and thousands of applications.

Save on upkeep, too

He can show you the way to maintenance savings you may never have thought possible with fluid mixers. A sensible program for reducing machine obsolescence, and keeping replacement costs low.

Before you select a fluid mixer for *any* purpose, find out how much time and effort you can save by checking first with MIXCO. Get the facts now on the LIGHTNIN guarantee that protects you unconditionally. Call in your LIGHTNIN representative—or write us today.

- ☐ DH-50 Laboratory Mixers
- ☐ DH-51 Explosionproof Laboratory Mixers
- ☐ B-102 Top Entering Mixer (turbine and paddle types)
- ☐ B-103 Top Entering Mixer (propeller type)
- ☐ B-104 Side Entering Mixers
- ☐ B-106 Condensed Catalog (complete line)
- ☐ B-107 Mixing Data Sheet
- ☐ B-108 Portable Mixers (electric and air driven)

MIXING EQUIPMENT Co., Inc.

131 Mt. Read Blvd., Rochester 11, N. Y.

In Canada: William & J. G. Greey, Ltd., Toronto 1, Ontario

Please send me, without obligation, catalogs checked at left.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

"Lightnin® Mixers"

GET THESE HELPFUL FACTS ON MIXING

LIGHTNIN Catalogs contain practical data on impeller selection; sizing; best type of vessel; installation and operating hints; full description of LIGHTNIN Mixers. Yours without obligation. Check and mail coupon today.

MIXCO fluid mixing specialists

PETROLEUM PROCESSING
MARCH 1954

And Now—A 'Big Union' in Oil

- **WHAT'S "BIG OIL?"—One union for all oil industry employes—industry-wide bargaining—probably taking in petrochemicals too**
- **HOW SOON?—Before year's end — constitution is to be ratified by August — union to organize soon after**
- **WHAT DOES IT MEAN?—New organization has potential coverage of 73 big refineries, almost 4,000,000 b/d, about 50% of nation's capacity**

THE day of the big industrial union is now at hand for the petroleum processing industries. A full-fledged, industry-wide, across-the-rank-and-file union, approaching in stature and strength those in the steel, coal, and automotive industries, is now in the making.

This "new" union began to take definite shape at a meeting at Philadelphia's Bellevue-Stratford Hotel Feb. 15-18 of 149 delegates from 31 different groups—the Oil Workers International Union (CIO) representing less than half of petroleum's organized workers, 26 scattered independent unions, and four AFL units.

A timetable established by this convention set August 23, or shortly thereafter, as a target date for a constitutional meeting. It also set June 15 as the date when individual unions which will separately consider going into the new union must have settled the question of ratifying the proposed constitution.

The stage was set for the Philadelphia meeting about a year ago, when representatives from the OWIU and 22 other unions held a meeting of the "National Coalition of Oil Workers' Unions" to formulate plans and a program leading to the call for the recent "merger" convention.

Far greater power in dealing with oil company management and on a broader, industry-wide basis is a certain outcome of the merger into the new integrated organization, to be known as the Oil & Chemical Workers International Union.

Major oil companies, on some not too-distant day, could find themselves bargaining through a committee, much as does the steel industry, with a settlement "pattern" being set for the industry's smaller companies.

In the event of a major dispute, a united front such as the new OCWIU would present could tie up an estimated 50% of the nation's refinery capacity, or almost 4,000,000 b/d of crude capacity, based upon the 73 larger refineries which could be affected.

By comparison, two years ago during the general strike of 1952, 56 refineries were shut down, cutting off about 35% of the refining capacity.

Membership-wise, the potential gain of this new OCWIU, with the 212,440 charter members it would have as represented in the Philadelphia talks, was seen as nearly one million oil, gas, chemical and related workers in the United States and Canada.

Final decision on a consolidation did not come until the end of the week-long, closed-door sessions in Philadelphia. However, it had been early regarded in most quarters as a mere formality. For one thing, the rules of the convention, as well as the official call to the meeting, had specified that:

". . . by his presence a delegate indicates that he and his organization approve in principle of the idea of the formation of an international industrial union."

A double motive for the "merger" convention was given by the officially-designated spokesman for the delegates. Economic conditions today were the "primary motive" but the "tougher" management attitude under the Eisenhower administration was another important reason, according to Wood H. Honeycutt, secretary of the Independent Industrial Workers Association, an independent union representing Esso Standard Oil Co. workers at the Baton Rouge, La., refinery.

Fear of a layoff was the way the union man explained the "economic conditions." In fact, layoffs were regarded as an accomplished fact, apparently, and the chief complaint was "We don't know how big *the* layoff might get."

No report on the extent of layoffs in the oil industry had been made at the convention, Honeycutt admitted. Nor did he have any information that there was any substantial amount of unemployment in the industry.

There have been some layoffs, however, he pointed out. In the case of his own company (Esso Standard), he said, three pipe stills had been shut down at Baton Rouge the preceding week, and the butyl rubber unit operated by Esso at the plant for the government has been shut down "indefinitely" on order of the government.

This pipe still shutdown meant that 27 men employed on these units had to take lower paying jobs elsewhere in the plant and an equal number

Unions Represented at Merger Meeting

Union Name	Company	Voting Strength and Total Membership	Delegates Potential	Delegates Seated	Refinery Capacity b/d
Allied Oil Workers Union	Ethyl Corp., Baton Rouge, La.	1,500	6	3	
Associated Petroleum Employes	Magnolia Petroleum Corp., Beaumont, Tex.	4,500	9	2	170,000
Atlantic Independent Union	Atlantic Refining Co., Philadelphia, Pa.	11,600	16	16	143,000
Central States Petroleum Union	(25 locals of Indiana Standard Oil)	30,000	25	25	384,000
Asiatic Petroleum Employes	Asiatic Petroleum Co.	75	3	2	.....
Esso Employes Association	Esso Standard Oil Co.	400	3	3	.....
Bayonne Independent Oil Workers	The Texas Co.	250	3	2	.....
Bayonne Marine Employes Union	Esso Standard Oil Co.	150	3	1	.....
Employes Ass'n. of Bayonne	Tide Water Associated Oil Co.	1,500	6	3	87,500
Gulf Employes Ass'n. of New England	(described as office employes)	150	3	2	.....
Gulf Employes Ass'n. of New England	(described as operating group)	600	5	1	.....
Independent Alliance of Petroleum Employes	(not given)	250	3	1	.....
Independent Oil Workers of Paulsboro, N.J.	Socony-Vacuum Oil Co., Inc.	2,000	6	2	76,000
Independent Industrial Workers Ass'n.	Esso Standard Oil Co., Baton Rouge, La.	7,000	11	5	312,000
Independent Oil Workers of Norco, La.	Shell Oil Co.	675	5	2	50,000
Independent Oil Workers of Oklahoma	Continental Oil Co.	1,375	6	2	58,000
Independent Petroleum Union, Inc.	Esso Standard Oil Co., Baltimore, Md.	1,500	6	4	60,000
Independent Petroleum Workers of New Jersey	Esso Standard Oil Co., Bayway, N.J.	3,700	8	4	148,000
New England Labor Organization	Socony-Vacuum Oil Co., Inc. (Sales)	900	5	4	.....
Oil Workers International Union		130,840	36	36	2,201,000
Orange and Black Associates	(not given)	200	3	3	.....
Petroleum Ass'n. of Labor	(not given)	750	5	5	.....
Petroleum Trades Employes Union	(not given)	475	3	2	.....
Petroleum Union of Buffalo	(not given)	400	3	2	.....
Refinery Workers Federal Labor Union, AFL	Standard Oil Co. (Ohio), Lima, Ohio	500	3	2	43,000
Standard Refinery Union, Inc.	Esso Standard Oil Co., Bayonne, N.J.	2,000	6	6	35,000
United Petroleum Workers	Tide Water Associated Oil Co. (marketing)	250	3	2	.....
Western States Service Station Employes Union	Standard Stations, Inc.	6,000	10	2	.....
Office Employes International Union, AFL	(not given)	600	5	1	.....
Operating Engineers, AFL	Shell Oil Co., Wood River, Ill.	1,600	6	3	185,000
Laborers Organization Service Station Employes, AFL	Havertown, Penn.	700	5	1	.....
	Total	212,440			3,952,500b/d
	Current average refining capacity				8,000,000b/d

of mechanics had to be similarly reassigned. As for the rubber unit, 35 men who were employed in its operation also had to take lower paying jobs.

Although the provisional constitution approved at Philadelphia reportedly made no mention of ways and means of affiliation with other unions, O. A. Knight, president of the OWIU and a vice president of CIO, recommended to his own delegation in a caucus prior to action on the floor that it vote for proposed groundwork for consolidated unions.

The constitution calls for election of a president, one vice president, and a secretary-treasurer, all of whom must be full-time administrative officers, and for election of a 13-member executive board, all of whom must be rank-and-file union members. Such members are interpreted by the constitution as meaning members not on the payroll of the international. This provision was made "to assure membership control of the organization."

Extensive powers are granted to this executive board, according to a formal press release from the convention, including the power to reverse almost any action of the officers, and the power to remove officers from their posts in case of failure to abide by the constitution, or dereliction in duty.

Dues for financing the proposed union were the thorniest issue at the Philadelphia convention. The meeting went into one of its two night sessions to arrive at a per capita dues figure of $1.35 for the new international. This figure will have to be "sold" to some unions which make much smaller assessments, if the ratification drive is to enlist them. So also, will the idea of giving up local union independence have to be "sold."

Whether such a consolidated union as emerges will affiliate with the CIO, of which Mr. Knight is a vice president, remains to be decided—after the new union is activated. Mr. Knight, however, was a key figure in the Philadelphia convention, with his OWIU's claimed membership strength of more than 130,000 behind him.

The entire petrochemical industry is also a potential target of the new union should it grow as anticipated to include the country's chemical workers. The CIO's Gas, Coke, and Chemical Workers might enter the projected union: there has been friendly communication between them and elements at the Philadelphia meeting.

Questioned as to whether the inclusion of gas and chemical workers could raise jurisdictional problems between the new OCWIU and the United Gas, Coke and Chemical Workers Union (CIO), Mr. Knight said that any such problems could be "worked out in a peaceful way."

One probably important reason for the success of the plan for a merger could be traced to the rising strength of the OWIU and its president, Mr. Knight. This is the group that called the plays in the refinery strike of 1952, which at one point tied up 56 refineries and about 35% of the country's crude throughput.

As indicated by the information in the accompanying table, a new industry-wide union—OWIU-dominated—will add about 16 more unions, located at some of the nation's bigger refineries. There are some non-refinery unions in the table too, as well as some whose locations were not reported. However, a high percentage of voting strength is represented by OWIU's 130,000 and Central States Petroleum Union's 30,000 members out of the 212,440 total.

Based on the current throughput of all refineries which can now be affected, any labor dispute of major proportions could shut down about 73 plants and an estimated 4,000,000 b/d of capacity, or around 57% of the country's petroleum supplies.

In addition, the big Baton Rouge tetraethyl lead plant of the Ethyl Corp. and a number of marketing, marine, and office employes of refining companies would be involved.

Besides voting strength on the convention floor, delegates in favor of merger dominated the important committee concerned with drafting the

KEY TO UNION MERGER WAS THIS COMMITTEE, who prepared the provisional constitution at the meeting in Philadelphia*

constitution. Its 11-man roster included four OWIU members (including Mr. Knight) and two CSPU members. Finally, an interim committee, set up to handle affairs between the Philadelphia meeting and the constitutional convention in August, is headed up by Mr. Knight as chairman.

The interim committee presumably is to receive certificates of ratification of the proposed constitution by the various unions going into the consolidation. Local unions, in considering ratification, will not be permitted to make any changes in the proposed constitution. It was pointed out that only the new OCWIU, after it is operating, will be able to amend the constitution; just as only that union can decide on the question of whether or not to affiliate with any other union.

On the matter of ratification by the OWIU itself, Mr. Knight said it probably would be 90 days before his own organization could act on the question. Provisions in its own constitution require such matters to be settled by convention or referendum.

An exact breakdown of the petroleum companies affected by the new OCWIU was not available. However, a count of the oil companies hit by the 1952 strike, plus those whose independent union representatives were present for the "nose-counting" in Philadelphia, shows a total of about 31 firms, including most of the majors.

The merger scheme for oil industry unions is not new. Last month's meeting in Philadelphia resulted from almost three years of plunking for merger by the 130,000-member Oil Workers International Union (CIO). For example, in July, 1951, OWIU invited unions in the oil and allied fields to merge by distributing a 16-page booklet describing its record and operations, saying, in effect:

The largest oil industry union at present, OWIU wants to better its bargaining position by increasing membership. As inducements, it pointed to such assets as: collective bargaining with hundreds of oil companies for over 30 years . . . more than 600 contracts in force with oil and chemical companies . . . a full-time staff of 65, most with 15 years or more of collective bargaining experience . . . legal, research and education, and publicity departments . . . full-time Washington representative . . . headquarters in Denver, with eight district offices.

Actual strategy meetings for strengthening petroleum unions began with a meeting in St. Louis in November of 1951, at which time 18 independent and AFL unions accepted OWIU's invitation to join its drive for a united front wage program. By the time a second strategy conference was held in Kansas City in February, 1952, the number of unions working within this loosely knit coalition had increased to 22.

The co-operative effort sagged somewhat during the strike in spring of 1952, but several independents stayed with OWIU all the way. However, the "coalition" was at that time described as pretty much of a fizzle, and in September, 1952, President O. A. Knight said the efforts to strengthen the coalition would be broadened.

Then, over a year later—this past December, 1953—153 representatives from OWIU and 22 independent unions met at what was termed a meeting of the "National Coalition of Oil Workers Unions" in New York City. Definite plans and a program were formulated, leading to the call for the "merger" convention in Philadelphia last month.

An arrangement committee, established to make preparations for the "merger" discussions, was headed up by Maynard M. Sands, president of the Central States Petroleum Union, as chairman. CSPU, comprising 25 locals and representing employes of Standard Oil Co. (Indiana), is the largest independent, non-OWIU union, with a total membership reported of 30,000.

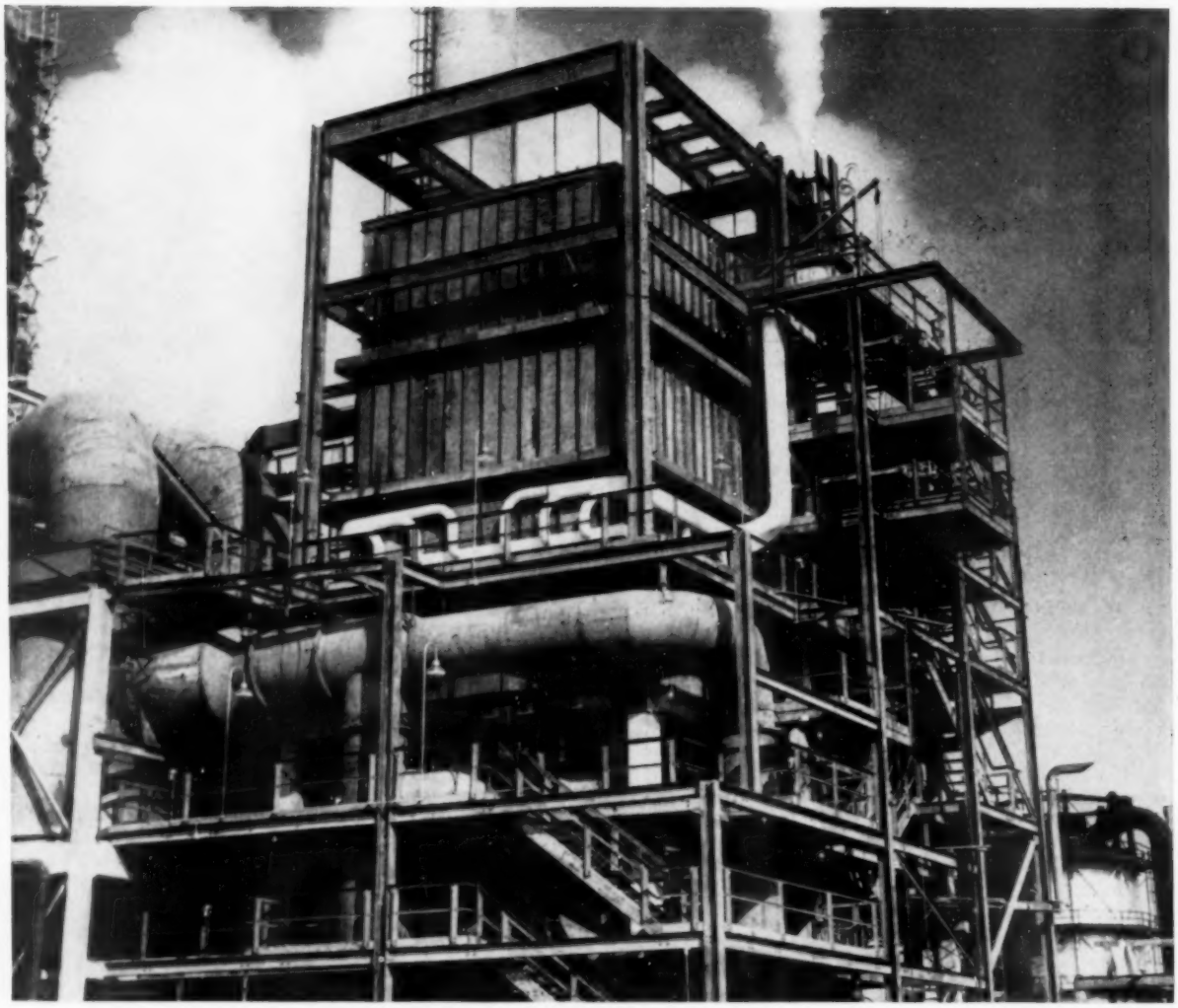
Sands subsequently became temporary and finally permanent chairman of the February meeting in Philadelphia.

Throughout the nearly three years of effort can be seen a thread of continuity and the firm hand of guidance by OWIU and its president, O. A. Knight. For example, in Denver, at that union's own national convention, Oct., 1953, Knight said OWIU was seeking to strengthen the coalition of oil unions in the United States.

"We are on the brink of the greatest development we have ever seen in our union," he predicted.

---

* Clockwise around the table: D. D. Boyett, Independent Oil Workers Union of Okla.; A. D. Herring, A. A. Marcos, J. E. Brown (all OWIU); J. T. Lambert, Independent Oil Workers of Norco; H. A. Warnock (chairman), Standard Refinery Union; D. C. Carey, New England Petroleum Labor Organization; O. A. Knight, OWIU; M. J. Cahill, Central States Petroleum Union; G. R. Papp, Bayonne Texaco Employes Ass'n.; Paul Huber, CSPU.



CAN A BOILER BURNING FLUE GAS help you make your . . .

Cracking Unit a Source of Heat?

Yes, here's a way to make steam by burning the flue gas, then superheating it in the regenerator

By O. F. CAMPBELL and N. E. PENNELS
Sinclair Refining Co.

PRODUCTION of approximately 400,000 lb./hr. of 550 psig., 750° F. total temperature steam is a unique feature of Sinclair Refining Co.'s new 40,000 b/d Fluid catalytic cracking unit at Houston, Texas.

Source of this fuel-saving, additional heat is a combination carbon monoxide boiler and respray steam superheater, installed and put into operation on the Fluid unit late last year.

Saturated steam at 700 psig. in the amount of over 300,000 lb./hr. is produced in a direct-fired unit to recover both the sensible heat and the heat of combustion from the Fluid unit regenerator flue gas, being derived from its CO content. This saturated steam in turn is superheated to 750° F. total temperature in a fluidized bed respray steam superheater.

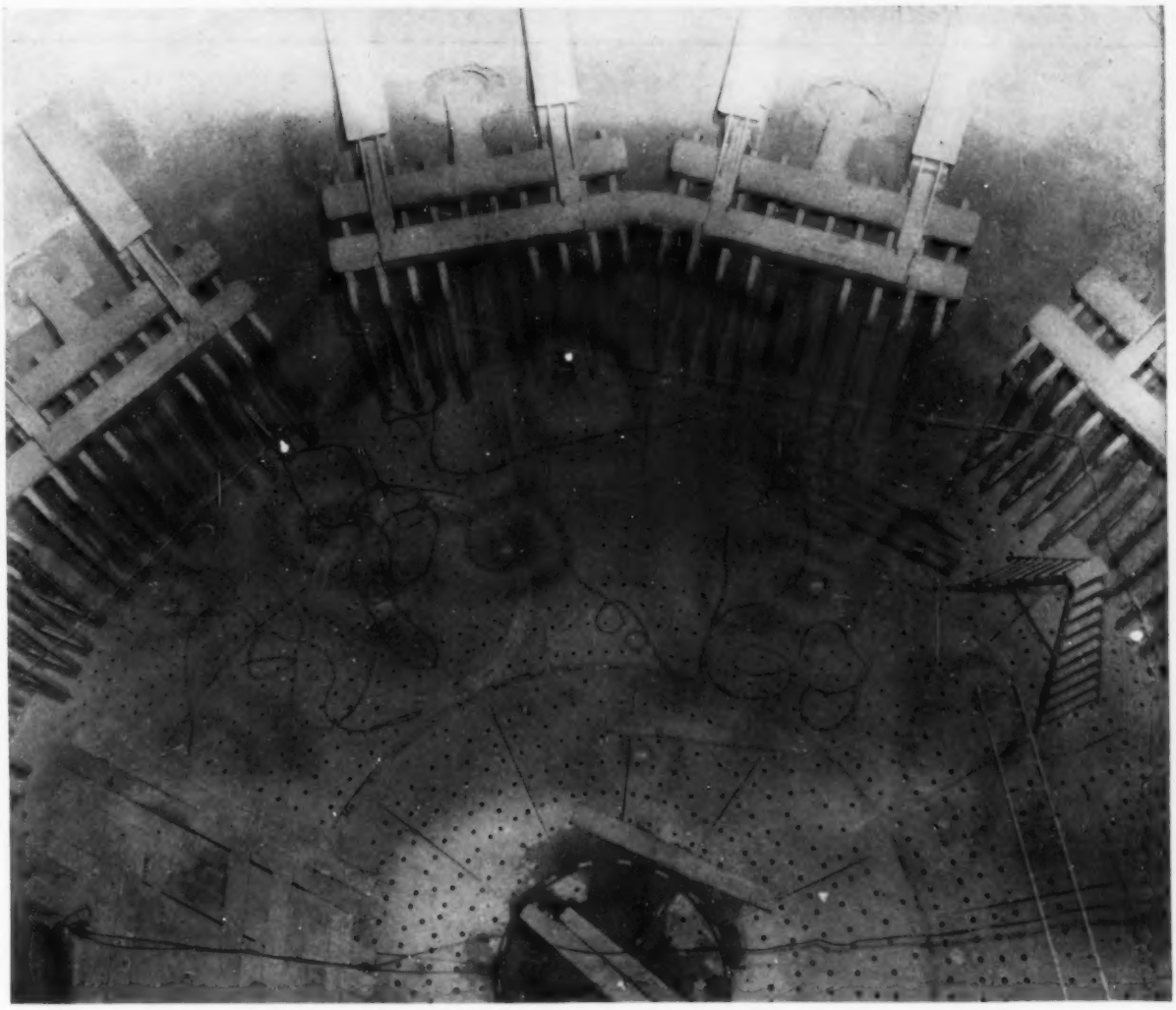
About 100,000 addition lb./hr. of steam is produced in this superheater, and the unit allows simultaneous control of both the regenerator bed temperature and the steam superheat.

Nine distinct advantages are seen by Sinclair in this equipment, which has been a natural outgrowth of the company's policy to operate Fluid units on a non-heat balance basis and aimed at conserving fuel and electric energy.

1—The Fluid unit is independent of outside sources of steam and energy during operation, shutdown, or startup.

2—Complete control of steam production for the Fluid unit is under the supervision of the cracking unit operators.

3—Steam can be produced at high pressure and temperature, which decreases the steam requirements per hp.



STEAM COILS IN THE REGENERATOR also help in this heat recovery system

for Fluid unit prime movers.

4—Carbon monoxide escape and possible pollution of the atmosphere is prevented by the installation.

5—Unburned hydrocarbons or other malodorous gases are likewise prevented from escaping into the atmosphere as probable air pollutants.

6—The flue gases are conditioned for subsequent removal of solids.

7—Excess steam is produced for other refinery uses, thereby reducing the output of refinery-fired boilers.

8—No additional fired boiler is needed for startups and shutdowns of the cracking unit.

9—The cost of the CO boiler and its appurtenances is no greater than a fired boiler of equivalent output.

The carbon monoxide boiler consists essentially of a pressurized primary cylindrical refractory furnace and a secondary water-cooled furnace with an economizer. It is illustrated in the photograph and in detail in Figs. 1, 2, and 3. Its final design was developed by Sinclair along with C. F. Braun & Co., prime contractor for the Fluid unit at Houston, and Babcock & Wilcox Co., manufacturer of the CO boiler.

The boiler includes a by-pass so that it may be shut down without shutting down the Fluid unit. Even though pressurized boilers were in early stages of development at the time of the design and Sinclair had no experience with pressurized furnaces, the very nature of the CO boiler dictated pressurized operation. The CO was already under pressure. The great volume of low Btu gas made induced draft operation excessively expensive.

Pilot plant work, conducted in 1950 on a Fluid unit at the Marcus Hook refinery, had demonstrated that low Btu carbon monoxide could be burned completely under reasonable operating conditions—with 10 to 20% excess oxygen in the flue gas and thorough mixing at a temperature above 1450° F. Thorough mixing was necessary to insure complete combustion with a minimum amount of auxiliary air.

Another important decision was whether the combustion chamber should be water cooled or a refractory furnace. Water cooled design offered a lower capital cost. However, the heat absorption from the combustion chamber increased auxiliary fuel requirements, thereby requiring a larger boiler which compensated for the added cost of the refractory type. Also, the refractory furnace offered minimum auxiliary fuel consumption with maximum certainty of maintaining combustion temperature at a reasonable cost.

The best mixing method among several that were studied seemed to be to inject the CO gas into the primary furnace tangentially through several inlet ports at different levels. This would set up a swirling action to mix

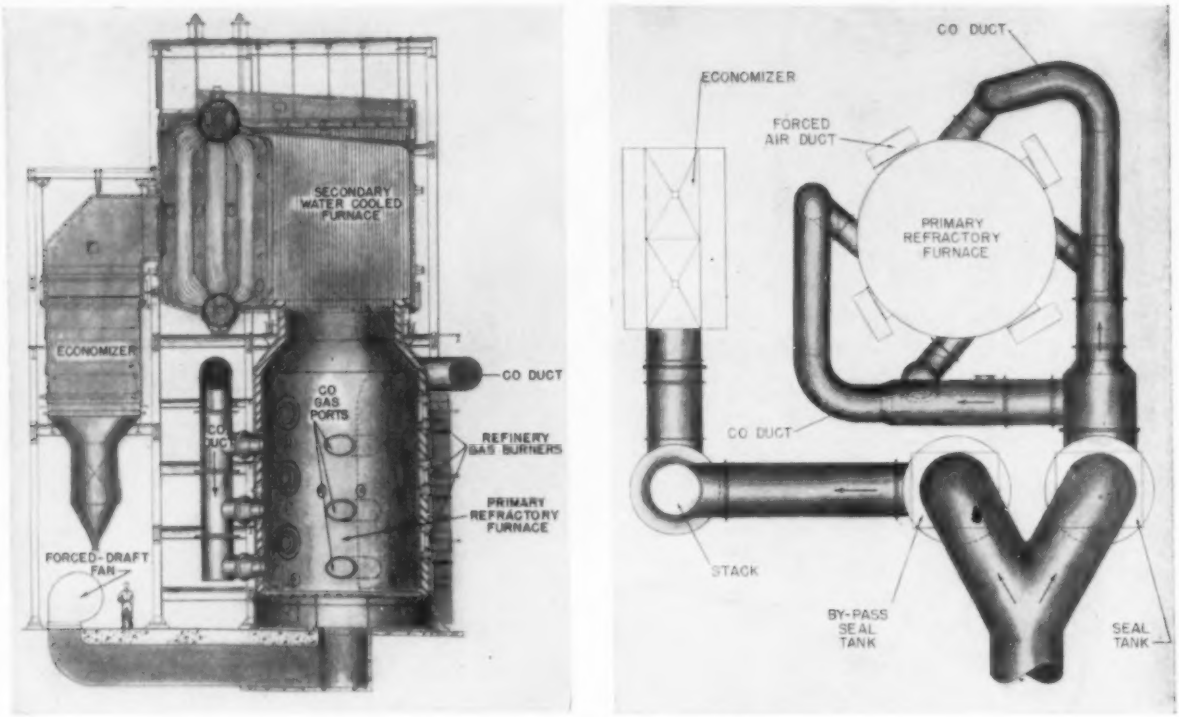


FIG. 1—Elevation and plan view of the carbon monoxide boiler

the CO thoroughly with the auxiliary fuel and air which would be fired through several burners located at different levels.

To make sure of completely burning the dilute CO, it was decided to fire sufficient auxiliary fuel to raise the gases to approximately 1450° F. without taking credit for the heat of combustion of any CO. This heat would raise the temperature above 1450° F. and provide a safe design and operating margin.

Final design of the primary furnace was for operation up to 2500° F., so that the boiler could be fired with high excess air to produce 220,000 lb./hr. of steam with no CO for the startup and shutdown periods on the Fluid unit. CO was injected through 12 tangential inlet ports, symmetrically located with four ports at three different levels (see Figs. 1 and 2).

Twelve auxiliary fuel burners were located in a similar manner. The top level of burners was above the top level of CO ports so that the CO-bearing gas would have to pass through a top level of fire before it left the primary furnace.

The secondary furnace is a conventional, water tube, single pass boiler. The arrangement of the top-supported secondary furnace over the bottom-supported primary required a water seal to provide for the downward expansion of the secondary and upward expansion of the primary.

To insure continuous operation of the Fluid unit, a CO by-pass system was designed. The plot plan in Fig. 1 shows that the CO may pass through a water seal tank to the boiler or through a by-pass seal tank directly to the stack. A typical seal tank is shown in Fig. 3. When the water is drawn out, the gas passes down through the internal pipe, up the annular space, and out the side duct. A multi-vane damper (not shown) is installed above the seal pot to provide partial closure so that the water seal may be established. The small pipe off the side of the inlet duct was provided to bleed off the gas by-passing the damper and make the water seal easier to establish. Operation has now shown it was not needed.

Feedwater for the CO boiler is condensate from the vacuum surface condenser of the Fluid unit turbine drivers, and hot lime-synthetic resin treated water from the main boiler house. A deaerating feedwater heater provides final deaeration and feedwater storage.

All controls for the boiler are on the Fluid unit main control panel. Boiler feed pumps are pressure-controlled by throttling the turbine steam with provisions for starting up and shutting down either pump from the board. The pumps are protected from low-flow seizing by automatic low-flow recirculation. The controls include three-element feedwater control and automatic combustion control of the auxiliary fuel and air to control the primary furnace temperature. Boiler feed pumps and the forced draft fan are turbine-driven and the controls are pneumatic, to make operation free from power failures.

Operation of the CO boiler has been entirely successful since it was placed onstream in October, 1953. Tables 1 and 2 summarize four performance tests made during November. Steam production varied from 303,900 to 315,000 lb./hr. The 990° F., CO-bearing gas from the regenerator varied from 650,000 to 679,000 lb./hr. CO content on total gas was 4.8 vol.-%. Complete combustion was obtained with a primary furnace temperature of 1775 to 1825° F. with an oxygen content of 2.5 to 2.7 vol.-% in the total boiler exit flue gas.

Total heat input to the CO boiler is shown to be approximately 430 million Btu/hr. Of this, about 180 million is the sensible heat of the CO, 140 million is its combustion heat, and 110 million is the auxiliary fuel and air. Thus, waste heat amounts to 320 mil-

lion Btu/hr., or 74.5% of the heat input.

Heat balance of both the gas and the steam sides of the CO boiler are shown in Table 2. The steam side indicates a higher heat absorption than the gas side in all cases. The difference varies from 0.4 to 3.3%. It is felt this is a good check. A mistake of 0.1% in the Orsat analysis for CO in the regenerator flue gas is equivalent to 2.5 million Btu/hr.

Several interesting developments showed up in the initial operation of the CO boiler. Tangential entry of CO gases produced the desired mixing as evidenced by complete combustion of CO at 1800° F. with 2.6% oxygen in the flue gas. The swirling action was more pronounced than was expected. It produced a cyclonic effect which increased the pressure at the face of the furnace to as much as 8 in. water above the pressure in the center of the primary furnace. That pressure value was 3 to 4 in. water less than the pressure in the secondary furnace. Therefore, the turbine-driven, forced draft fan had to be speeded up to provide the necessary static pressure to force the auxiliary air through the cyclonic wall of gases.

Another feature is the use of "Diamond I. K." retractable soot blowers to keep the boiler and the economizer clean. During the design period, there was considerable discussion as to whether the catalyst fines would collect on the boiler tubes.

It was decided to install 12 soot blowers, eight in the boiler passes and four in the economizer. Operations have shown that catalyst fines definitely collect in these locations. The blowers have been entirely successful in keeping the tubes clean when used on a once-per-shift schedule. There has been no collection of catalyst fines in the primary furnace.

Control has been very easy, although automatic control of the primary furnace temperature has proved unnecessary. The quantity, temperature, and CO content of the regenerator flue gas are so consistent that the primary furnace temperature does not vary enough to require automatic control. As a result, boiler operation to date has been on manual. High and low temperature alarms warn of abnormal conditions.

The respray steam superheater, located in the regenerator fluidized bed, was installed only after preliminary test work to determine the heat transfer rate and the feasibility of such an installation.

Tests on heat transfer rate consisted of inserting a one-inch, water-cooled

Table 1—Test Data, Carbon Monoxide Boiler

Test Number	1	2	3	4
CO-bearing gas:				
Quantity, 1000 lb./hr.	650.4	650.9	679.2	678.6
Temperature, °F.	990	990	993	993
Composition, Mol-%:				
Carbon dioxide	8.2	8.1	7.8	7.8
Carbon monoxide	4.8	4.8	4.7	4.9
Oxygen	4.5	4.5	4.5	4.5
Nitrogen	67.5	67.4	67.7	67.8
Water vapor	15.0	15.2	15.3	15.0
Total	100.0	100.0	100.0	100.0
Aux. fuel (natural gas):				
Quantity, 1000 lb./hr.	4.75	4.75	4.63	4.63
Temperature, °F.	73	76	78	80
Higher heating value, (Btu/lb.)	23,186	23,178	23,391	23,351
Aux. air:				
Quantity, 1000 lb./hr	108.0	103.7	106.7	111.4
Moisture, 1000 lb./hr.	1.6	1.5	0.5	0.7
Temperature, °F.	72	74	66	66
Flue gas:				
Quantity, 1000 lb./hr.	764.75	760.85	791.03	795.33
Temperature, °F.	503	511	530	530
Composition, Mol-%:				
Carbon dioxide	12.3	12.3	12.0	12.0
Carbon monoxide	0.0	0.0	0.0	0.0
Oxygen	2.6	2.5	2.6	2.7
Nitrogen	69.6	69.5	69.9	70.0
Water vapor	15.5	15.7	15.5	15.3
Total	100.0	100.0	100.0	100.0
Primary furnace, °F	1815	1825	1775	1775
Primary furnace pressure, inches water	13.1	13.1	13.1	13.0
Steam (saturated):				
Quantity, 1000 lb./hr.	305.7	303.9	315.0	313.2
Pressure, psig	710	710	715	710
Boiler feedwater:				
Quantity, 1000 lb./hr.	330.0	328.0	340.0	338.0
Temperature, °F.	235	235	235	235

Table 2—Test Heat Balances, Carbon Monoxide Boiler
(million Btu/hr.: datum—0° F.)

Test Number	1	2	3	4
Gas side:				
Heat in:				
CO-bearing gas:				
Sensible heat	175.26	175.38	183.95	183.53
Combustion heat	135.40	137.60	141.39	144.09
Auxiliary fuel:				
Sensible heat	0.16	0.17	0.18	0.18
Combustion heat	110.16	110.12	108.28	108.09
Auxiliary air:				
Sensible heat	1.93	1.90	1.69	1.77
Total	422.91	425.17	435.49	437.66
Heat out:				
Flue gas	113.18	114.34	122.42	123.76
Radiation (0.5%)	2.11	2.13	2.18	2.19
Total	115.29	116.47	124.60	125.95
Total heat absorbed	307.62	308.70	310.89	311.71
Steam Side:				
Heat in:				
Feedwater	67.08	66.68	69.12	68.72
Heat absorbed	312.00	309.90	321.47	319.62
Total	379.08	376.58	390.59	388.34
Heat out:				
Steam	367.02	364.60	378.16	376.03
Blowdown	12.06	11.98	12.43	12.31
Total	379.08	376.58	390.59	388.34
Total heat absorbed:				
Gas side	307.62	308.70	310.89	311.71
Steam side	312.00	309.90	321.47	319.62
Difference	4.38	1.20	10.58	7.91
Percent Difference	1.4	0.4	3.3	2.5

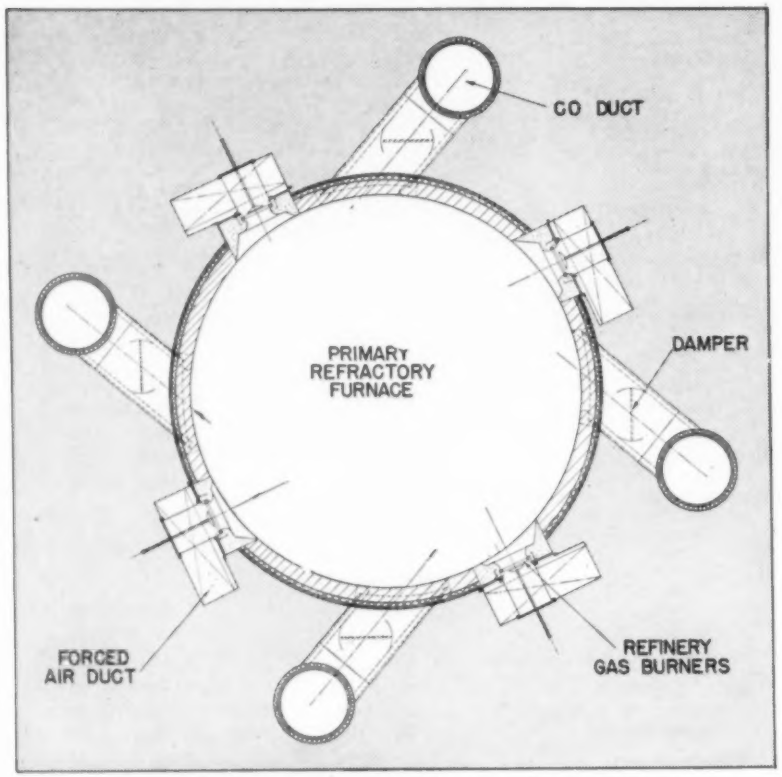


FIG. 2—Starting current vs. speed (% motor volts as parameter)

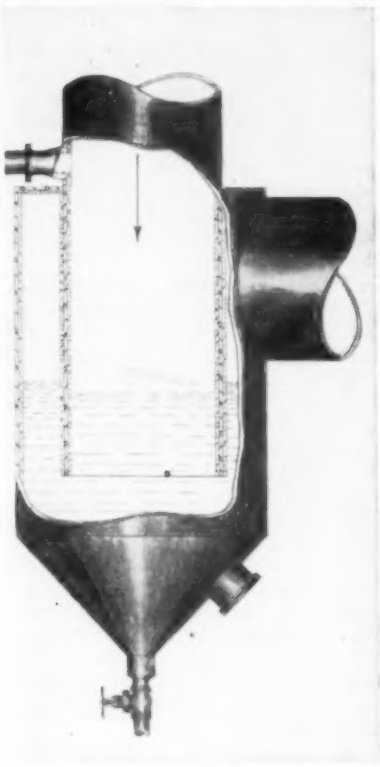


FIG. 3—Torque speed curves

bayonet, or probe, into the fluidized bed of an existing cracking unit. Rates were established reasonably close to data available in the literature by weighing the quantity of circulating water, obtaining water temperature rise and knowing the heating surface and the temperature of the bed.

Before operating the Houston superheater, Sinclair had obtained valuable experience in fluidized bed heat transfer at the Wood River, Ill., refinery. When that plant was purchased from Wood River Refining Co., the equipment included a heat balance type Fluid unit. A forced circulation boiler was designed with the heating surface immersed in the regenerator bed, to increase capacity, improve yields, and obtain better control of cracking conditions.

This was the only practical way to remove heat from the regenerator, since that unit was too close to the ground to use a conventional recycle boiler. The unit installed comprised 10 horizontal coils going around the wall of the regenerator, connected and valved to a common header and thence to a steam drum, with a circulating pump.

Operation at Wood River substantiated later-confirmed data at Houston. Total heating surface at Wood River was about 600 sq. ft. Heat absorption rates of approximately 50,000 to 60,000 Btu/sq. ft./hr. have been obtained with a temperature differential of about 700° F. The heat extraction can be controlled by 10% increments by cutting coils into or out of service, one at a time. At the end of a year's continuous service, no repairs were required on the Wood River unit.

The Houston installation, shown in Fig. 4, comprises four heat exchange coils, in series, immersed in the regenerator bed. Saturated steam from the CO boiler passes through these coils and is superheated by removing the excess heat from the regenerator. Just as the CO boiler is a "first," so is this method of controlling bed temperature by superheating steam a "first."

Coil construction is very similar to a superheater on a fired boiler. The material is Croloy 5 and has an indefinite life under conditions inside the regenerator with no steam flow through the coils. The general design is shown in the photo on p. 353.

The difference between this type of superheater and one in a boiler is the medium surrounding the coils. In a boiler, the hot flue gases flow past the tubes, whereas these coils are immersed in the fluidized bed of hot catalyst. The tubes are bombarded with the very fine particles and the heat transfer rate is greater than that in a conventional boiler. It appears to be from five to seven times greater for the same temperature differential. It would seem that consideration should be given to this method of superheating steam for public utilities that use reheat.

The ideal design for this system would be to have an exact balance between the quantity of steam available and the quantity of heat to be removed from the regenerator. Then, when steam passed through the coils, it would remove the desired amount of heat and it would be superheated to the desired temperature.

This, however, is not the case. For normal operation the quantity of heat to be removed from the regenerator is greater than is required to raise the temperature of the available steam from the CO boiler to the desired 750° F. Therefore, a system of desuperheating stations has been provided so the steam can be alternately superheated and desuperheated. A wide range of control is attained by this system, shown schematically in the flow diagram in Fig. 5.

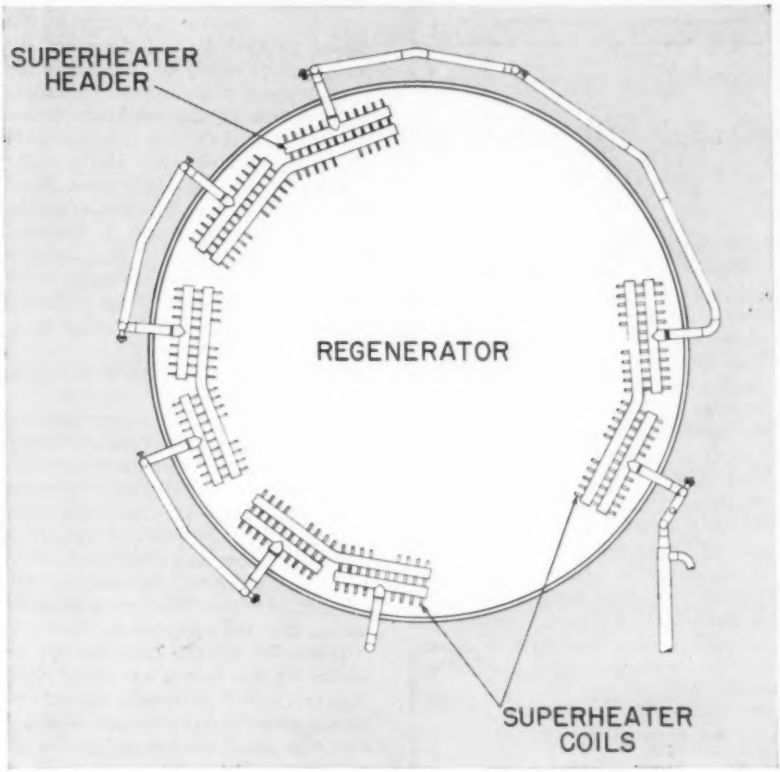


FIG. 4—Arrangement of steam superheater coils in regenerator

Two temperatures are controlled automatically by the superheaters—the regenerator bed at any point below a maximum of 1100° F. and the superheater steam at 750° F. The regenerator bed temperature controller varies the quantity of steam from the CO boiler passing through the coils by regulating a motor valve in a by-pass steam line around the coils. Thus, flow through the coils is indirectly controlled.

In Fig. 5, it can be seen that there are desuperheating stations at the inlet and outlet of each section of the superheater. At the outlet of the first, second, and third coils, provision is made to spray the superheated steam with condensate. (The desuperheaters at the inlet of the first coil and outlet of the fourth coil have different purposes.)

This spraying reduces the temperature of the steam and raises the temperature differential between steam and catalyst bed. Since the condensate is vaporized to steam, it also increases the quantity of steam flowing to the following coils. Both the reduced steam temperature and the increased quantity of steam make it possible to remove more heat from the regenerator. Thus, if the by-pass system will not hold the bed temperature because conditions get beyond the range of the controller, condensate spraying will help bring conditions into range.

Temperature of the final mix of steam from coils and by-pass is controlled by a controller which can vary the condensate flow to the desuperheater at the outlet of the fourth coil, to maintain a temperature of 750° F. This instrument can also vary the condensate flow to the inlet of this coil between certain limits.

This controller is set so it will first increase or decrease the condensate to the outlet of the fourth coil. If, however, the maximum quantity of condensate to this desuperheater will not control the blend temperature; condensate flow is started to the desuperheater at the inlet of the fourth coil.

A lower limit of 530° F. for control of the steam to the fourth coil was designed into the controller setting. It was chosen arbitrarily as being a satisfactory control point to prevent ever reducing the temperature to steam saturation temperature, which is 505° F. at 700 psig. This was done to prevent condensate evaporation in the coils, where evaporation would cause any soluble salts that might be present to be deposited.

When conditions are such that the temperature controller on the fourth coil inlet overrides the main steam temperature controller and the steam temperature is not under control, then the quantity of condensate to the other desuperheater must be increased manually to return the temperature to control conditions.

It was stated previously that the desuperheater on the inlet of the first coil was for a different purpose. During normal operation, it will not be in use since the steam from the CO boiler is already saturated steam. However, if it is necessary to operate the Fluid unit with the CO boiler shut down, the steam for bed cooling is the plant's 550 psig. steam, which has already been superheated to 750°F. During

Table 3—Test Data, Superheater

Test Number	1	2	3	4
Steam to superheater:				
Quantity, 1000 lb./hr.	305.7	303.9	315.0	313.2
Pressure, psig	710	710	715	710
Temperature, °F.	507	507	508	507
Condensate to superheater:				
Quantity, 1000 lb./hr.	81.0	87.0	94.0	87.0
Temperature, °F.	235	235	235	235
Superheated steam:				
Quantity, 1000 lb./hr.	386.7	390.9	409.0	390.2
Pressure, psig	540	540	540	540
Temperature, °F.	750	750	755	760
Total heat absorbed, million Btu/hr.	150.9	157.6	169.1	161.6
Regenerator bed, °F.	1067	1066	1059	1058
Log, mean temp. diff., °F.	362	368	386	365
Effective surface, sq. ft.	6000	6000	6000	6000
Overall heat transfer rate, Btu/hr./sq.ft/°F.	69.3	71.3	72.8	73.7

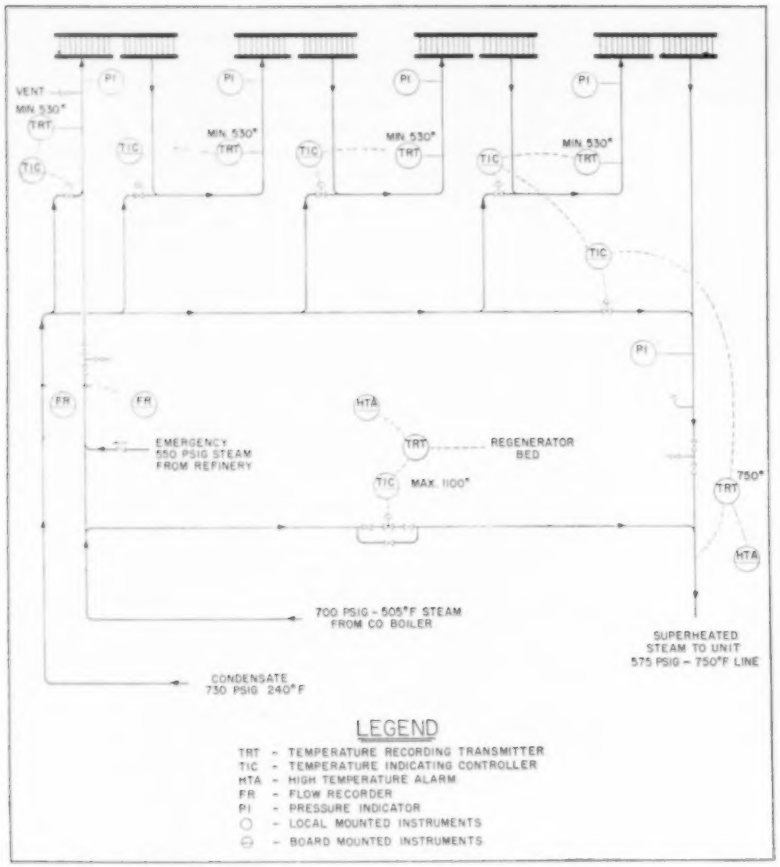


FIG. 5—Control scheme for superheater and desuperheaters

such a period, the first desuperheater would be used to desuperheat this steam to 530° F. and the other desuperheaters would be adjusted in the same manner as for normal operation.

Operation of the complete superheater system is entirely from the main Fluid unit control panel. The spraying water is condensate which comes from the main condenser for the condensing turbines of the Fluid unit. It is heated to approximately 240° F. in a separate section of the main CO boiler feedwater heater and it is pumped by turbine-driven pumps to the desuperheating stations. Automatic control is provided for these pumps at the main panel board.

If these pumps fail, desuperheating water can be taken from the main boiled feed pumps for the CO boiler. An automatic cut-in valve operates when the desuperheating water pressure drops below a set pressure. It is only in an extreme emergency that boiler feedwater will be used for this purpose, because the soluble salts would foul the superheater.

Operation of the unit to date is shown in the results of actual field tests in Table 3. A transfer rate of approximately 70 was obtained. The design was based on a transfer rate of 67.5.

The maximum heat absorbed to date was approximately 169 million Btu/hr. The amount of heat required to superheat the steam produced from the CO boiler to 750° F. would be approximately 80 million Btu/hr. Therefore, the heat absorbed by the respray steam superheater will vary between approximately 80 and 170 million Btu/hr. It will depend upon the amount of heat that is required to be extracted from the regenerator bed to hold the bed temperature at its desired level.

Operations to date have been better than were expected. The CO boiler produces steam at substantially a constant pressure and rate, and under these conditions even manual control of the regenerator bed temperature is satisfactory.

Acknowledgement

The authors acknowledge the following engineers for their assistance in the original design, drawings, photographs, construction, and operation of the CO boiler and the respray steam superheater:

H. S. Spaulding, J. Bowen, and M. Bason, of C. F. Braun & Co.

F. S. Nolte, C. L. Marquez, E. H. Manny, E. Durham, L. E. Hayward, J. Knoblesdorf, and L. G. Troutman, of Babcock & Wilcox Co.

W. S. Gullette, H. C. Kuhn, W. H. Decker, D. A. Stewart, R. S. Cooper, R. Y. Rankin, and W. F. Shippani, of Sinclair Refining Co.

Mr. Campbell

Mr. Pennels

Meet the Authors

O. F. Campbell is combustion engineer for the Sinclair Refining Co. He has been with the company since 1922 after graduation from Michigan with a degree in chemical engineering. He is a member of the American Petroleum Institute and the U. S. Committee on Flame Radiation Research, an American Society of Mechanical Engineers Fellow, and member of the ASME Committee on Air Pollution Controls.

Mr. Campbell also is a member of the Midwest Air Pollution Prevention Ass'n., Hammond (Ind.) City Planning Commission, and past chairman of the ASME Fuels Division and the Power Division.

N. E. Pennels was graduated from Michigan State in 1947 in chemical engineering and then joined Sinclair as a trainee in the research and development department. He spent four years in technical service at the Sinclair, Wyo., refinery, and one year as project engineer on design and construction at Houston. Since 1952, Mr. Pennels has been assistant combustion engineer of Sinclair.

Three 'Musts' in Chemical Cleaning

1 —Identify type of deposit to be removed
2 —Select correct solvent and inhibitor
3 —Use the most practical cleaning technique

By D. P. THORNTON, Jr.
Southwestern Editor

SOMETIMES spectacular results can be obtained with chemicals in cleaning various equipment in refineries, natural gasoline plants and petrochemical units — provided the problem is attacked scientifically.

In general, scale found on the water-side of coolers and condenser boxes, boilers and the general steam system responds readily to chemical cleaning, and at lower costs than with the older methods in terms of labor and equipment downtime. Sometimes chemical cleaning will produce results impossible with hand methods.

The process-side of much equipment often can be chemically cleaned, although it may be slower and more expensive than water-side treatment. Equipment which has been successfully cleaned includes exchangers, condensers, fractionators, absorbers and storage vessels. When the equipment becomes plugged, the cleaning job is complicated and may be impossible.

The effectiveness of process-side chemical cleaning depends largely on the nature of the deposits to be removed, and these may be of a large variety, particularly organic materials. Sometimes the work is complicated by having to protect the metal in the equipment by means of inhibitors in the cleaning solution.

Chemical cleaning may sometimes be combined with mechanical methods. For example, an exchanger bundle may be almost completely plugged on the shell side, so that chemical cleaning alone is impractical. Soaking the bundle in solvent will loosen the deposit so the bundle can easily be removed for mechanical cleaning. The combined time, labor and materials costs may be less than for mechanical cleaning alone. On the other hand, especially with more intricate tube and baffle arrangements, the bundle may be removed and deposits rough cleaned mechanically, then replaced in the shell for chemical treatment.

The service companies specializing in chemical cleaning are building up a backlog of case histories which, as experience data is accumulated, can be of great help to the processing plants in determining what chemicals to use and how to use them.

1 Identify Type of Deposit to be Removed

First requirement in planning chemical cleaning of plant equipment is to determine the nature of the deposit to be removed. This may almost amount to a research project, as organic accumulations will vary in different installations in the same plant, even from point to point in the same vessel. The deposits found may range from limestone-like carbonate scale in boilers or waxes and metal corrosion products, to the metal oxides and sulfide films usually found in gasoline storage tanks.

The analysis must detect the presence of metal salts resulting either from water treatment or corrosion; it must show how carbonaceous the deposit is and indicate the presence of oil, grease and tarry residues. Analytical techniques usually involve chemical and X-ray diffraction methods, less frequently the spectroscope.

Representative samples should be taken completely to bare metal. "Chunks" of deposit are more desirable than powdered samples, while sections of tube or metal with deposits in place, when available, are considered the most satisfactory. The samples should be secured from points where the most severe operating conditions for solids deposition prevail, usually as indicated by deposit thickness.

Other tests should include determination of solubility of deposits in hydrochloric and other mineral acids. Optimum treating temperature should be determined, also whether inhibitors and other additives may be needed to speed descaling yet protect equipment. The weight or volume of reagent required for solution per unit weight of deposit should be ascertained. Sometimes the amount of gas evolved per unit weight of deposit is taken as a measure of solubility.

For predominantly organic deposits the effect of degreasing materials may need to be studied, followed by testing the solubility of the sample in practical organic solvents such as carbon tetrachloride, methylene chloride and the like. Tests with combinations of strongly oxidizing acids (like nitric) with other reagents are made when warranted. Alkalies are often used to convert acid-insoluble scales into soluble form. A physical examination will reveal the existence of laminated deposits and porous accretions, and indicate the feasibility of removing otherwise insoluble compounds by attack on the binders which often hold them together.

The "tough babies" for chemical cleaning among deposits include calcium sulfate, carbonaceous matter and insoluble silicates.

Calcium sulfate, normally encountered only in boilers, is one of the most difficult inorganic deposits to remove chemically. It is generally stable and relatively insoluble in aqueous solutions. Deposits of calcium sulfate laminated between other type of scale are difficult to remove.

Highly carbonized deposits rarely are amenable to chemical cleaning unless adherence is due to a binder which can be attacked or dissolved chemically, and the carbon subsequently flushed out as a sludge. Pure coke cannot be removed.

Deposits high in silicates cannot be removed with hydrochloric acid. They are soluble in hydrofluoric acid and may be removed with difficulty by adding fluorides to hydrochloric acid. However, certain metals resist hydrofluoric acid very poorly and such materials as cast iron, which may have silicate-containing slag inclusions, may complicate this procedure.

Usually the cost precludes use of hydrofluoric acid although it may be successfully inhibited. A substitute method involves alternating treatment with acid and alkaline solutions. Choice of treatment and practicality

should be determined by laboratory analysis of the deposit and experience of the treating engineer.

A partial checklist of deposits found in refinery, natural gasoline and petrochemical plant equipment, most of which are removable by chemical means, is given in Table 1.

"Inorganic" deposits normally are water-insoluble metal salts, oxides and sulfides, usually found in the waterside of cooling equipment and boilers. They include oxides and sulfides which often are also found on the process side.

"Organic" deposits embrace a great variety of materials, ranging from hard, varnish-like deposits, waxes and various degrees of sticky polymers, to coke itself. They may or may not be impregnated with oil and quite commonly will contain some dispersed inorganic material. Included in this category are paint films and various protective coatings of a resinous character.

Table 1—Typical Deposits Found in Petroleum Processing Plant Equipment

Inorganic Deposits

Oxides of iron, copper, manganese
Sulfides of iron, copper, zinc
Calcium carbonate, bicarbonate, phosphate, sulfate
Magnesium carbonate, bicarbonate
Manganese carbonate, phosphate
Silicates of iron, copper, zinc, manganese, calcium, magnesium

Organic Deposits

Polymerized organic with iron oxides
Iron oxides and sulfide with some polymerized organic
Iron oxides and sulfide, mixed with oil
Highly polymerized organic, some iron oxides
Black, gummy scale with iron, iron oxides and sulfide
Gummy scale and iron sulfide
Soft, black, oily scale with iron oxides and sulfide
Iron oxides and sulfide, polymerized organic and oil
Fuel oil sludge, oil and rust
Fuel oil sludge and rust
Coke, iron oxides and sulfide with oil

2 Select the Right Solvent and Inhibitor

The "old reliable" for chemical cleaning work, especially inorganic deposits, is commercial hydrochloric (muriatic) acid. However, the raw acid alone is not commonly employed, as this may invite serious corrosion, doing as much or more damage than the deposits. HCl is readily available and of low cost. It is easily handled with a minimum of hazard to personnel, and is readily susceptible to modification by inhibitors, intensifiers, dispersants and wetting agents.

Sulfuric acid is less frequently used because of the lack of suitable intensifiers and the fact that some of its inorganic salts are insoluble in aqueous solutions.

Nitric acid is seldom employed because of its toxicity and other undesirable attributes.

Hydrofluoric acid is rarely applied as such, because of its cost, but rather as a salt in combination with hydrochloric acid.

Various caustics are used to convert certain acid-insolubles to soluble forms, to neutralize surfaces following acid treatment and washing, for passivation and as a degreasing agent. Basic solvents used in chemical cleaning are listed in Table 2.

Wetting agents are particularly valuable adjuncts to chemical cleaning because they reduce the surface tension of the solvent, permit readier penetration of porous scales and more intimate contact with oil-soaked deposits. This is important when the scale is a mixture of materials, some of which are insoluble or inert in the chemical solvent to be used.

It is not always necessary to circulate the solvent by mechanical means. Sometimes it is inadvisable to circulate it at all. Some circulation always occurs, however, due to thermal differences between the bottom and top layers and also because of the specific gravity differential, since solvent becomes heavier as it is spent. Where there is a low ratio of solvent-to-scale, as in cleaning exchanger tubes, fresh solvent may be used to displace spent chemical in lieu of circulation.

Foaming agents are sometimes added to the solvent to insure agitation, when it is impractical to circulate the solvent mechanically. Inert gas sometimes is used for this purpose also.

Circulation of solvent is not desirable in certain cases, such as in the presence of a large amount of copper in the scale (to avoid plating out metallic copper during treatment) or ferric iron (to prevent possible unrestrained corrosion not controllable with inhibitors). In these instances the best practice calls for displacing solvent with fresh solution to avoid high concentrations of these materials until the level falls to a safe value.

Inhibitors may be necessary to prevent excessive acid attack on metals with consequent evolution of hydrogen. They are particularly vital when there are two or more dissimilar metals in the system being cleaned, such as heat exchangers with steel heads and Admiralty tubes, copper or other materials. Properly inhibited, the chemical cleaner should not attack any one metal in the system more severely than another. The inhibitors, usually organic materials, are chosen with due consideration to the metal or metals to be protected, as some are specific in their protective action.

Electrolytic corrosion potentialities may be safely ignored, even though the treating solution may be a good

Table 2—Basic Solvents Used for Chemical Cleaning

Acids
Hydrochloric
Sulfuric
Phosphoric
Oxalic

Chlorinated Hydrocarbons
Carbon Tetrachloride
Trichloroethylene
Perchloroethylene
Methylene Chloride

Oxidizing Solvents
Permanganates
Chromates
Chlorates

Hydrocarbons
Kerosine
Diesel Oils
Light Gas Oils
Stoddard Solvent

Alkalies
Caustic Soda
Soda Ash
Phosphates

Table 3—Attack Rate of Inhibited* and Raw HCl on Various Metals and Alloys

(Attack, lbs./sq. ft./day)

Material	Inhibited 15% Acid			Raw 15% Acid
	100°F	150°F	175°F	150°F
Steel	0.0025	0.0182	0.0571	1.232
Cast Iron	0.0316	1.161	1.143	....
Admiralty	0.0013	0.0023	0.0032	0.00754
Copper	0.00059	0.00084	....	....
Brass	0.0004	0.0007	....	0.0025
Bronze	0.0006	0.0008	....	0.0025

* Nature of inhibitor varies with metal to be protected.

electrolyte. Contact time is too short for appreciable attack to occur and inhibitors prevent direct corrosion.

Table 3 compares the attack rate of 15% hydrochloric acid on various metals and alloys with and without the use of inhibitors. The effect of temperature also is shown.

3 Use the Most Practical Cleaning Technique

It is frequently desirable to heat the cleaning agent in order to speed the rate of attack on deposits. For most water-side scales using acid treatment, the temperature ranges between 130 and 160° F. However, it is dangerous to fire a boiler or a fired-reboiler containing hydrochloric acid-based solvent. The equipment should be preheated using any desirable means but there should be no "hot spots" when the solvent is introduced. The safest method of preheating acid-based solvent is by exchange with steam or by directing steam into the solution.

It is not always necessary to shut down a plant for chemically cleaning process facilities, or even to isolate certain parts or units. The feasibility of cleaning during operations will depend principally on the nature of the deposit and how difficult it is to remove, and the means for disposing of the spent cleaning agent. The operator must also consider the possibility of reduction of output or minor upsets.

Process-side cleaning of refinery and petrochemical plant equipment will sometimes involve isolating the vessel or part of the unit, if it is impractical to flood the whole system. Usually it is necessary to degrease the unit before applying chemical treatment.

Degreasing may be accomplished by circulating a light refinery stream, such as kerosine, diesel fuel, light gas oils or Stoddard solvent. The solvent may be recovered or diverted to slop tanks for reprocessing.

Degreasing is followed by steaming or air-blowing. Many times steaming is sufficient. Special alkaline-base solvents may be circulated through the system. Heated acid solvent then is circulated until the deposit is removed. An alternative method is to fill the vessel with degreasing solvent and also the acid solvent afterwards, allowing the reaction to occur while soaking.

In these cases, and depending on the nature of the deposit, it may be necessary to vent the towers of carbon dioxide or hydrogen sulfide. A small amount of hydrogen (small if the acid is properly inhibited) will be present. Proper precautions should be taken against ignition of any hydrogen produced and also to protect workmen from H_2S.

Storage tanks may be cleaned, if small, simply by filling and soaking, the same as for plant vessels. For the larger tanks and vessels which can be readily entered, a spraying technique is used.

In these cases, the solvent or acid is combined with a gelling agent and sprayed on the surfaces to be cleaned. Solvents like methylene chloride may be used with the gel to remove paint and coatings from interior and exterior surfaces. Methylene chloride is toxic when inhaled. Degreasing may be similarly accomplished with special thickened alkaline agents. The gel keeps the active ingredient in contact with the scaled surface for the desired length of time, after which it is flushed off—usually with water—and the metal given passivating treatment if desired.

Only a few hours normally is required for cleaning using the thickened chemical agent, depending on the nature of the deposit and how much soaking is needed. A 5000-bbl.-tank can be sprayed with the gel in 20 minutes.

To eliminate having men in the tank during the spraying, or building a scaffolding just for cleaning, a device is often used which consists of a vertical pipe dropped through the center manhole and a small gin-pole and pulley to control the sprayer. The vertical pipe is long enough to reach half way down the tank. A smaller pipe containing the spray nozzle is attached to the vertical line by a hinge joint. A ball bearing holds the vertical pipe and permits rotating the spray gun by hand through a complete circle.

It is necessary for the spraying crew to wear suitable clothing (and air masks, if required) when cleaning large tanks and horizontal vessels with a man-way at one end. These range from 5000-bbl. tanks in chemical service to 50,000-bbl. fuel oil tanks. Sometimes they contain heating coils and internal bracing. The tanks may contain petroleum products, alcohol, ethylene glycol and the like, paint and varnish components and edible substances. Deposits may range from fuel oil sludge to oil and rust, mill scale, metal sulfides and paint.

Scaled and fouled pipe lines within the processing or gasoline plant can be cleaned by flooding with the chemical agent just as in a heat exchanger. A variation is to use an adaptation of the familiar pipe line "pig" equipped with brushes and a nozzle through which chemical is sprayed.

Another practice is to use a nozzle on a length of pipe, inserting this through a blind flange equipped with a packer. The solvent is sprayed on the pipe walls circumferentially, and spent solvent is allowed to drain from the line at some downstream point. Thickened solvent may be used if desired, as in tank cleaning.

Many companies find it preferable to use service companies for cleaning work, rather than attempting to do it with their own crews. The advantages cited include no capital investment in specialized cleaning equipment, no interruption in the normal maintenance routine, and no time required in specially training plant cleaning crews. In addition, a company specializing in chemical cleaning accumulates a backlog of experience which may prove useful in solving your own special problems.

8 Jobs Done by Chemical Cleaning

THESE actual cases of chemical cleaning in refineries, natural gasoline and petrochemical plants, were compiled from data supplied by operators, and by service companies specializing in chemical cleaning.

Water-Side Cleaning Debutanizer Condensers

The water-sides of two typical debutanizer condensers were cleaned without affecting regular process operations, in a large Midwestern refinery. The product going through the tube side (coming off the debutanizer column) was at 152°F. Water was going through the shell side at 50° F. at a rate of 229 gpm. Liquid capacity of each unit was 300 gal.

The scale deposit was difficult to remove even when the units were shut down. The scale normally ranged in solubility from 65 to 75%. The laboratory analysis was: Ignition loss, 10-15%; SiO_2, 3-10%; $Ca(SO_4)$, trace to 3%; phosphate, negative; iron, heavy.

Preparations for the treatment were simple. A tie-in was made to the dis-

Turn page for 7 More Jobs . .

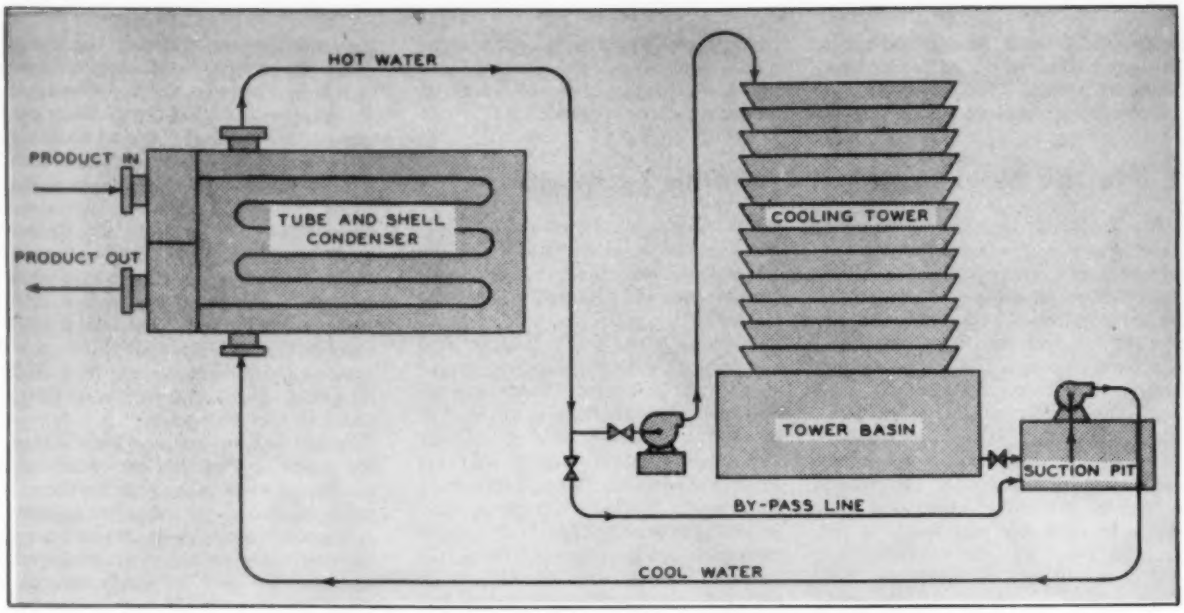


FIG. 1—Arrangement for chemically cleaning the water-side of condensing equipment in a natural gasoline plant

tributing header and solvent was pumped into the water flow at a predetermined rate. The heat transfer coefficient was raised from 40.8 Btu./sq. ft./hr./°F., at the start, to 58.5 within 30 minutes after commencing to pump acid. Water rate increased from 229 gpm. (before) to 343 gpm.

Following treatment, the unit was recovering 70 bbls./hr. more reflux than before. Part of the reflux is used to control the tower temperature. Initially, there had been difficulty controlling column temperature because the reflux was 152°F. After cleaning, the reflux was going back into the tower at 101°F. Less product was required for temperature control, so more could be sent to product storage. Cleaning these units in operation conserved the butane which had been sent to the flare while the equipment was shut down. This saved the operator $75.00/hr.

Gasoline Plant Cooling System

The 5000 gpm. water cooling system of a large natural gasoline plant in Texas was operating at only 60% of design, with commensurate processing inefficiency. It consisted of 20 shell-and-tube condensers, compressor and engine water jackets and all service lines. The system was a continuous loop having a volume of 12,000 gal. exclusive of the cooling tower and basin.

Samples were taken of the deposits at various points in the system and analyzed by X-ray diffraction. They were found to consist principally of a reddish-brown iron oxide with some additional calcium carbonate, calcium sulfate and silicates. No organic material was present.

Hydrochloric acid was chosen as the reagent and inhibited to avoid corrosive attack on metals in the system.

Due to the large volume of the system, the chemical agents were brought to the site and mixed, rather than isolating portions of the system for individual treatment with pre-mixed solvent. The suction pit for the cooling tower was employed as the mixing tank.

As indicated in Fig. 1, the cooling tower basin was drained and a by-pass line installed from the cooling tower pump to the suction pit, thus isolating the cooling tower from the system. After draining the system as completely as possible, the suction pit remained about half full of water, leaving 3000 gal. which could be picked up by the circulating pump before it lost suction. To this was added 1000 gal. of concentrated chemicals and the 4000 gal. was pumped into the system.

This procedure was repeated twice to completely fill the system. Then the solution was completely circulated to obtain an homogenous mixture. Samples were taken at various points to check uniformity. The system then was circulated at half-hour intervals for four hours, to wash out any scale which might slough off the walls.

Concentration of reagent in the system was determined periodically and after 4½ hours this leveled off to a constant value, indicating that most of the scale had been removed. The solvent was left in the system 9½ hours more. The solution then was drained from the system, followed by a water wash.

The service company handling this job provided a 1000-gal. pumper and a 2000-gal. acid transport, cleaning engineer and two equipment operators. Pumps on the service truck introduced solvent into the system and the plant cooling water pump was used to circulate the diluted solvent solution and wash water. After treatment it was found the system could be operated again at full design capacity. The improved performance of the plant paid for the cleaning job in a matter of days.

Fresh Water Lines In an Old Refinery

The lines were crusted with iron tuberculations, silt and sludge. The section to be cleaned was 11,000 ft. long and included pipe ranging from 10-in. to 16-in. diameter. Parts were buried, a portion ran under a bayou, the balance above ground. Estimated replacement cost, in lieu of chemical cleaning, was approximately $100,000.

Chemical solvents totaling 102,000 gal. were pumped into the system through existing connections, completely filling it, and allowed to soak for a 24-hour period. Fresh water then was pumped through the system until all traces of solvent disappeared. It required only 38 hours to satisfactorily restore this system.

Salt Water System In a Chemical Plant

Salt water mains ranging from 10 to 14-in diameter and 13,000 ft. in length in a Gulf Coast chemical plant, were incrusted with deposits up to 4-in. thick. It required 60,000 gal. of chemical solvents to fill this system, after which there was an 8-hr. soak period. Following this, salt water was used to flush out the system before returning it to service. Before cleaning, the lines showed pressure drops from the pump stations to consuming points of up to 68 psig. Afterwards the observed pressure drops were comparable to those expected with new pipe.

The Case of the Stubborn Sewer

The 20-in. refinery sewer system had deposits of scale, a "Duke's Mixture," from 6 to 14 in. thick, which the plant crew had been attempting to remove mechanically for three weeks, when chemical cleaning was decided upon. Only seven days remained before the plant was scheduled to be put back on stream. A chemical cleaning service did the job in six days with chemical solvents, removing approximately 370 cu. ft. of scale. After cleaning, the sewer was again able to handle its design capacity of 1.3 million gal./day.

Process (Shell) Side Of Commingler Condensers

These condensers are regular tube and shell units holding about 800 gal. each on the shell side, connected in series-parallel as shown in Fig. 2. They act as absorbers, the gas from the compressors in the catalytic cracking area being contacted in them with light gasoline fractions from associated fractionating facilities.

The condensers normally operate at 140 to 150 psi. but when fouled, the operating pressure increases to 165 to 175 psi. It is important to keep these condensers in efficient operation until the catalytic cracking unit goes down for scheduled clean out, as they cannot be taken off the line without shutting down the whole unit.

The condensers have been cleaned in operation about five times during the last three years. They have also been cleaned more thoroughly during a down period. In each instance there was considerable evolution of H_2S.

In chemical cleaning the solvent was introduced into the suction side of the product pump, where it mixed with the product. Both the pressure and temperature increased momentarily as the solvent was added, but they quickly settled back to a pressure of approximately 20 to 25 lbs. less than initial pressure. The spent solvent was drained from the debutanizer water leg. The last two treatments reduced the operating pressure of these units from 164 psi. to 142 psi. and from 175 psi. to 150 psi., respectively.

A number of amine coolers and condensers at this refinery also have been cleaned on the water side in the same manner. These units were operating at 115 to 125°F. during the cleaning operation.

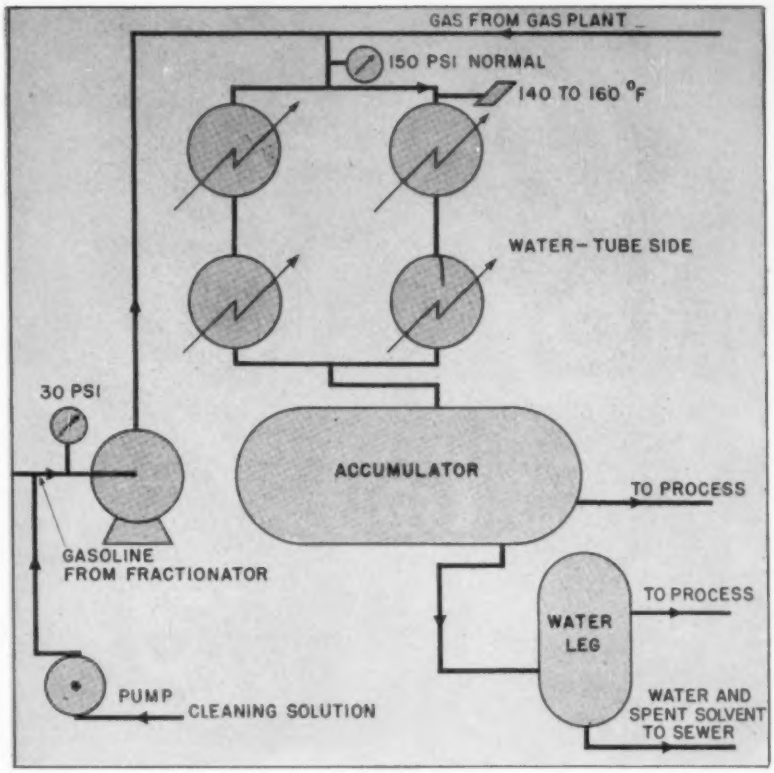


FIG. 2—Cleaning commingler condensers without interrupting processing

Large Floating-Roof Gasoline Storage Tank

It was necessary to remove mill scale from a 60-ft. diameter tank and passivate the floating roof in preparation for painting. Thickened, inhibited hydrochloric acid was used. The tank top was floated completely down at the time of spraying. It was impossible to spray down in the tank due to the fumes from the acid, so spraying was done from a catwalk around the top. A ⅜-in. I. D. open nipple and high pressure hose were used to cover the 2826 sq. ft. of surface.

About one hour was required for hooking up and spraying the thickened acid. After 17 hours soaking, the solvent was flushed from the tank top. One hour was required for the flushing. The sludge was removed through a drain in the center of the tank top. Most of the material was flushed by spraying water from the catwalk, the last portions being flushed down from on top of the tank with the same equipment.

Passivating solution was then sprayed from the catwalk, which completely removed the small amount of light brown after-rust which formed after the water flushing stage. About 10 minutes time was required. The operator applied the prime coat of paint the same afternoon and to date the entire operation has proved satisfactory.

Gas Line in a Petrochemical Unit

About 80 miles of 4-in. gas line supplying a petrochemical plant was fouled with rust and iron sulfide. A slug of inhibited hydrochloric acid was pumped through the line, followed by a water wash. Both fluids entered the effluent disposal system. Tests showed the gas capacity of the line had been increased 46.2% through chemical cleaning, with only a minor interruption in plant operations.

41,625 B/D CAPACITY is the goal in Imperial Oil's program for remodeling its 22,000 b/d refinery at Imperoyal, a project claimed to be . . .

Canada's Biggest Refinery Project

THE largest refinery construction project ever undertaken in Canada is planned for Imperial Oil Ltd.'s Maritime refinery at Imperoyal, near Halifax, N. S.

In a building program estimated to cost between $25 and $30 million, Imperial, Canadian affiliate of Standard Oil Co. (N. J.), will replace most of its existing plant with a brand-new refinery of almost double the present capacity.

When construction is complete, the Maritimes will have a refinery that incorporates the latest developments in petroleum processing, including one of the largest Fluid catalytic cracking units in Canada. It will be the most modern plant of its kind in the world, according to Imperial.

Daily capacity of the revamped refinery will be 41,625 bbls., which will make it one of Canada's major refineries, bigger than anything west of the Great Lakes and—in the Imperial family of nine refineries—surpassed only by the plants at Sarnia and Montreal. Present capacity at Imperoyal is 22,000 b/d.

Engineering design for the new plant is under way. Construction is scheduled to start early in 1955, with completion in the summer of 1956. The existing plant will continue in operation during the construction.

One of the features of the expanded refinery will be a 27,000 b/d Fluid unit—among the largest "cat crackers" in Canada.

Other refining equipment to be installed includes a 41,625 b/d atmospheric and vacuum distillation unit, a catalytic polymerization unit, gas recovery plant, treating plant, and a naphtha specialty plant.

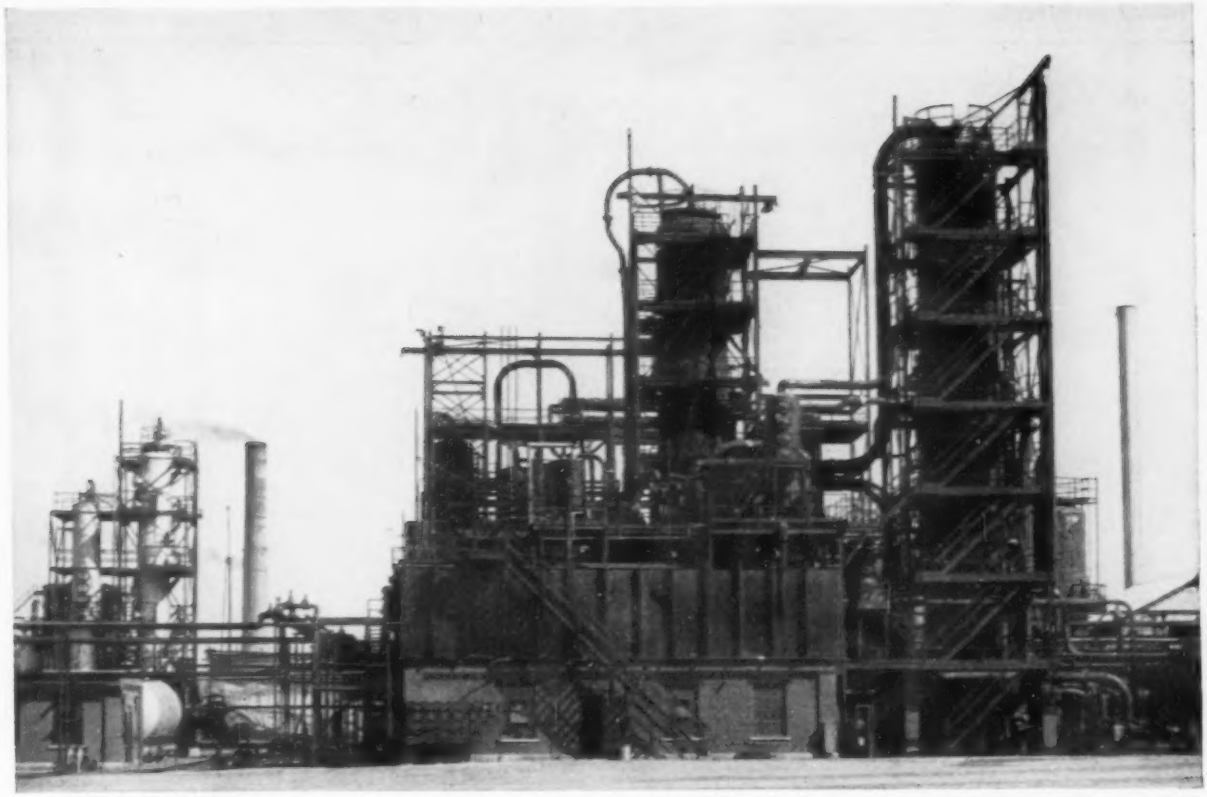
Additional construction will include mechanical shops for the enlarged plant, a laboratory and technical building, loading racks, and facilities for providing the refinery with water, steam and electricity.

The new refinery will be built on the present plant site at Imperoyal, across the harbor from Halifax and three miles south of Dartmouth. The site covers 616 acres, and has harbor frontage of 4840 ft.

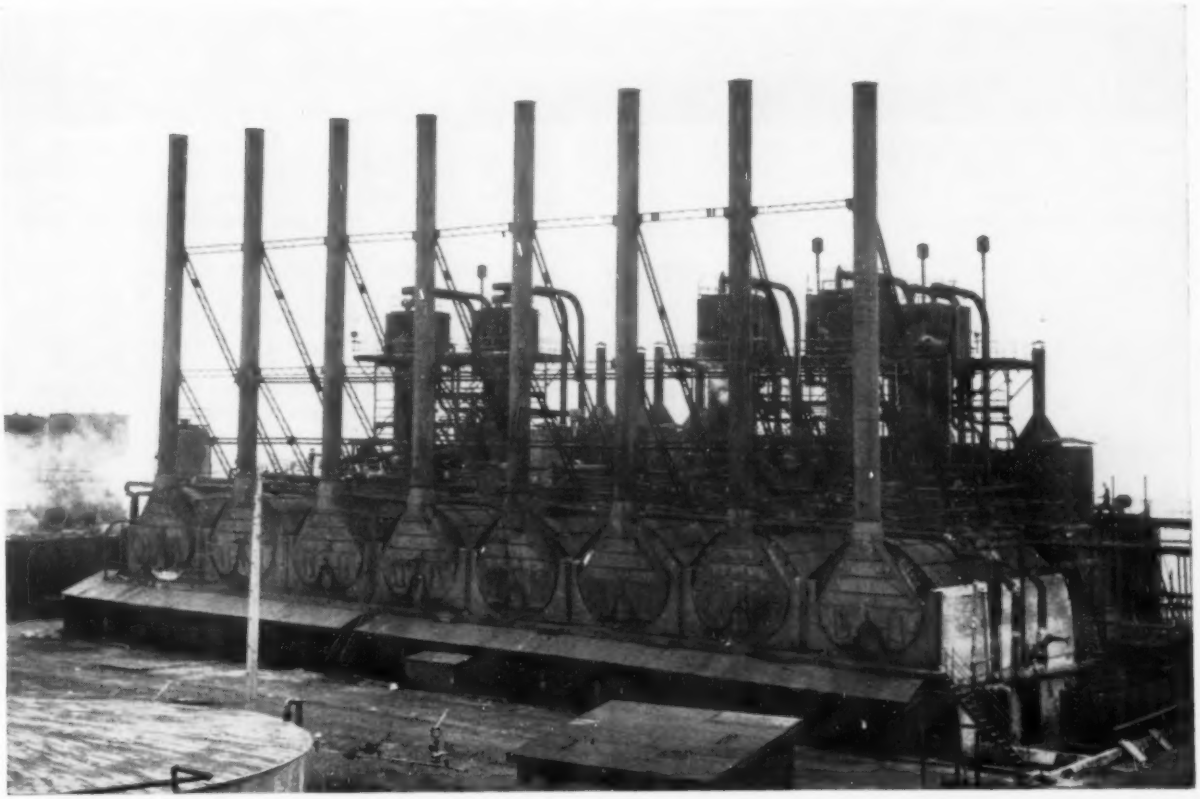
The original refinery at Imperoyal was built by Imperial during World War I to take care of the needs of Atlantic shipping. Construction started in 1916, and the plant was put on stream in 1918 with a daily capacity of 2200 bbls. Since then the plant's capacity has been increased steadily to 22,000 b/d.

Superintendent at Imperoyal is George R. McMillin, who is no stranger to either the plant or Halifax. He joined Imperial Oil as a laboratory assistant at Sarnia in 1933 after graduating in chemical engrg. from the U. of Toronto. He became senior chemist at Sarnia, and in 1938 was loaned to International Petroleum at Talara, Peru, as asst. chemist.

On his return in 1939 he was named chief chemist at Imperoyal, and in 1944 was made asst. superintendent. He went to Sarnia again in 1948 as group supervisor in the engineering and development division. Two years later he was appointed asst. superintendent of the Sarnia refinery, and in October, 1952, became superintendent. He took over the Imperoyal post Jan. 1.



SOLE SURVIVOR in Imperial's rehabilitation project will be this combination crude unit and thermal cracker



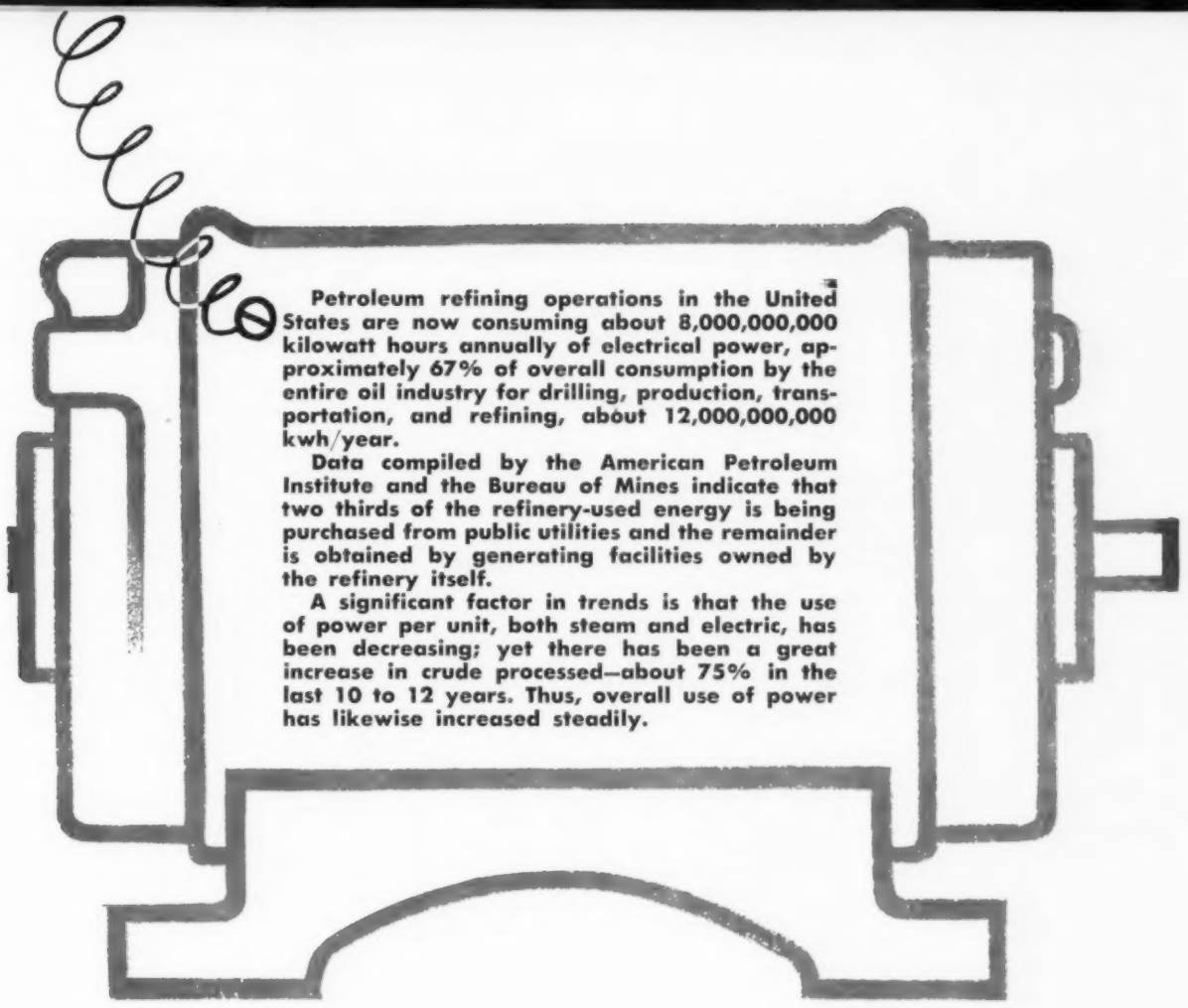
VINTAGE 1916, these crude oil batch stills at Imperoyal will be retired as part of the refinery modernization

HIGHER OCTANE GASOLINE will come from this new 12,000 b/d "Catformer," recently put on stream at the Philadelphia refinery of Atlantic Refining Co. First of its type on the East Coast, this catalytic reforming unit has enabled the company to start marketing 94.5 octane gasoline, up from 93 octane, the top rating of its previous premium grade motor fuel. By-product hydrogen from the unit will be used in a new synthetic ammonia plant

AMERICAN REFINING STUDIES by team of technical representatives from Yugoslavia. Group is inspecting a process unit at the 6300 b/d refinery of Rothschild Oil Co., Los Angeles, Calif. They are part of a team on a country-wide tour being sponsored by the U. S. Foreign Operations Administration to supply the visitors with first-hand operating information—the object: "helping the Yugoslavs help themselves."

In the picture, left to right, are: Kornelije Mirkov, consulting engineer for oil and gas, federal planning board, Belgrade; Bruno Tomassi, distillation chief of the Rijeka refinery, largest in Yugoslavia; Harold Wylie, assistant plant superintendent for Rothschild; Karlo Krainer, production manager of Sisak refinery; Mrs. Mira Hropic, laboratory chemist at Rijeka refinery; and Hans Wehner, an interpreter.

There are three refineries in Yugoslavia, Rijeka, Sisak, and Bosanki Brod, with a combined throughput capacity of about 14,000 b/d, roughly one-third that of an average U. S. plant. Top gasoline is 72 octane (research). Total vehicle population of the country includes approximately 25,000 trucks and about 20,000 motor cars. The seven-man team of engineers visited many plants during a stay in this country from Jan. 15 to February 25



Petroleum refining operations in the United States are now consuming about 8,000,000,000 kilowatt hours annually of electrical power, approximately 67% of overall consumption by the entire oil industry for drilling, production, transportation, and refining, about 12,000,000,000 kwh/year.

Data compiled by the American Petroleum Institute and the Bureau of Mines indicate that two thirds of the refinery-used energy is being purchased from public utilities and the remainder is obtained by generating facilities owned by the refinery itself.

A significant factor in trends is that the use of power per unit, both steam and electric, has been decreasing; yet there has been a great increase in crude processed—about 75% in the last 10 to 12 years. Thus, overall use of power has likewise increased steadily.

Large Motors in the Refinery

—their selection and application

By CARL M. LATHROP and EDWARD J. WINSOR
Standard Oil Development Co.

IN large petroleum processing units today there is still a sizable portion of the total power load being supplied by steam drives. In most cases this is because the steam-driven load represents a single large unit.

Examples include the air blower in a catalytic cracking process, or the centrifugal gas compressor of a light ends unit. These range in sizes from 2500 to 6000 hp. at more than 5000 rpm.

How can these large drives best be served? What are the factors affecting them? How can they be evaluated?

Four general points must be considered in selecting and applying large motors in refineries, and this discussion will therefore be separated into those four sections:

1—Economic selection of drives.
2—Engineering the application.
3—Protecting large motors.
4—Operations.

The problem involves both mechanical and electrical factors and a broad viewpoint is required. However, the items of most interest are electrical.

1—Selecting the Drives

Some large motors have been used in the oil industry for many years—that is, sizes larger than 1000 hp. In the past, these drives have been on services requiring a lower order of reliability than processing equipment. It is only recently that motors in excess of 1000 hp. have been applied to processing facilities.

The reason for the lack of use of large motors in process units is accounted for largely by the lack of reliability in the electric power distribution system. As time goes on, distribution systems are being made more and more reliable, and the reliability factor becomes less burdensome in the justification.

It is not the purpose here to establish absolute values of reliability. Rather, it is up to the individual applying the large motor to determine whether or not the particular installation has sufficient reliability for the purpose. On the basis that the system under study is suitable for serving a process unit, it can be concluded that the selection of driver is one of economics.

In applying economic principles to

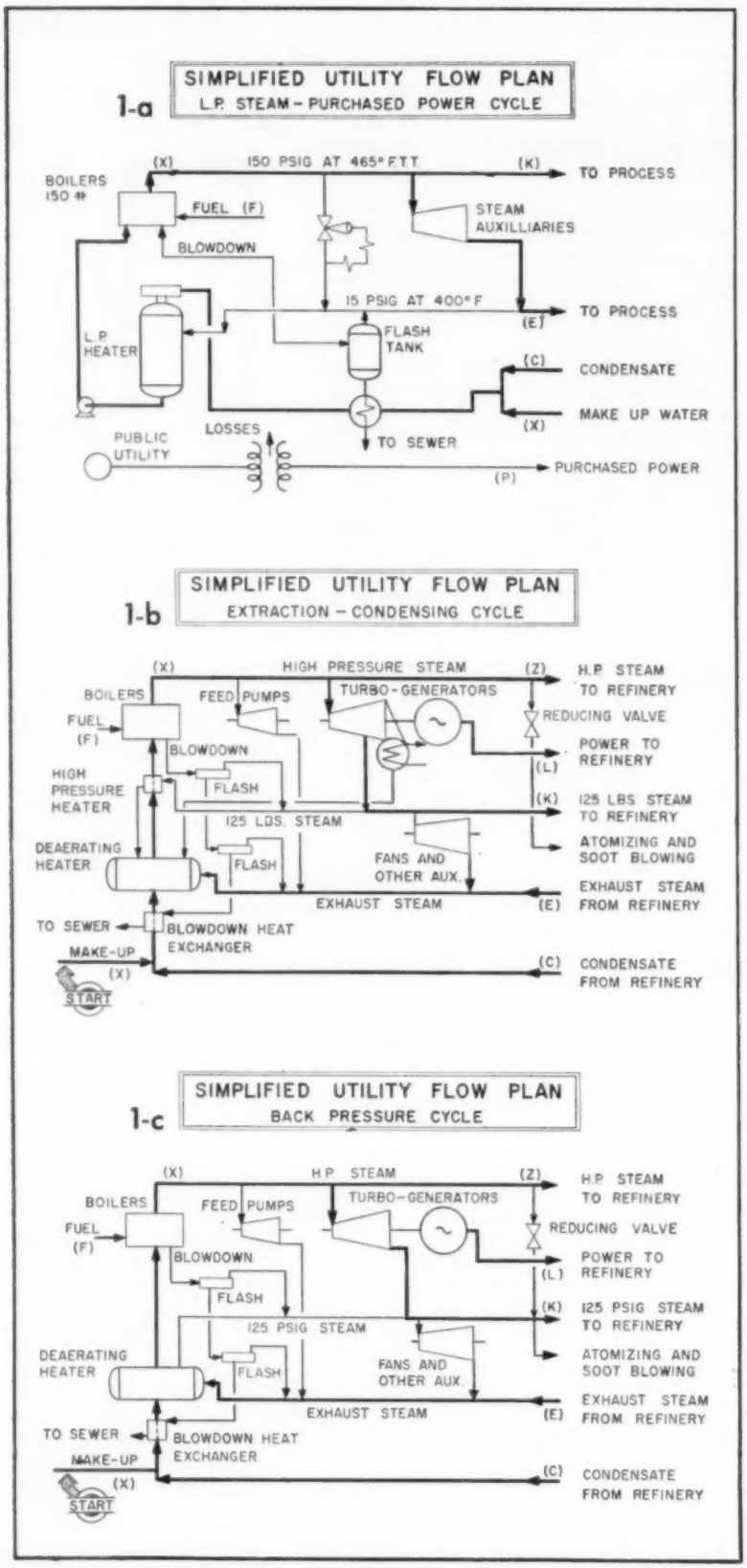


FIG. 1--Overall refinery heat balances for three different kinds of operation. These are basic and must be prepared early in a power study.

the selection of prime mover, it is necessary to consider all related factors.

A common mistake is made when only the direct onsite cost of the motor and its starter, or a steam turbine, or similar drive are considered. There are many other factors that enter into the selection from an economic viewpoint.

All offsite costs must be considered. For example, in the case of a steam turbine drive there is, in addition to the turbine, its control and immediate steam lines.

There is also the offsite boiler plant, water treating facilities, and distribution system. Similarly, with the electric motor drive there is the portion of distribution system between the process unit and the source, whether or not the source be selfgenerated or purchased power. Furthermore, most process industries require steam and this factor must be included along with the horsepower requirement.

HEAT BALANCE

The fundamental source of data for sizing all of these attendant facilities comes from the "heat balance" for the installation. This is basic and must be prepared early in the work.

An over-all refinery heat balance may be simplified to a system similar to that shown in Fig. 1. In the figure are shown three typical heat balance cases: under 1A, plant steam generation at 150 psig (usually associated with the purchase of power); and under 1B and 1C, the generated power case (also for the high pressure plants).

It is usual, when power is purchased, that steam for process use is generated at a nominal pressure of 150 psig, and supplementary energy is purchased from an outside source in the form of electric power. Fig. 1B represents steam generation at a nominal pressure of 600 psig with attendant electric power generation. It will be noted that power is being generated on the combination back-pressure and condensing cycle.

Fig. 1C is for installations where the steam load is great enough to permit back-pressure generation.

These heat balances are highly generalized. Any specific application would undoubtedly be different in some minor detail. For the purposes of an economic comparison between steam and electric drive, however, the heat balances shown here are considered to be adequate.

Local fuel cost will have some effect on the heat balance of the installation being studied. For example, in ex-

tremely high-fuel-cost areas the steam pressure would quite likely be 900 psig, whereas in low-fuel-cost areas, i.e., 10¢/MM Btu, the generation pressure might be 400 psig.

Table 1 lists the equations for calculating the various circuits. The terms in the equations are identified in Fig. 1. For example, k is the 150 psig process steam to the refinery and is shown on the appropriate line on each diagram.

The equations yield actual loads. Continuity of operation requires that spare operating equipment be provided. This will be discussed further in the next section on Investment Cost.

The heat balance diagrams and equations apply equally well to both the electric drive cases and the steam drive cases. In the latter instance visualize the turbo-generators to be the large steam prime movers. The process load, usually expressed in horsepower is converted to kilowatts for use in the equations.

Table 1—Heat Balance Equations

PURCHASED POWER—FIG. 1A

$x = 1.21k+1.19E$
$X = 1.08k+1.08E-1.00C$
$W =$ nil.
$F = 1480k+1450E$
$P = 1.1Lh$

EXTRACTION-CONDENSING—FIG. 1B

$x = 0.81k+1.20z+0.81E+14.0L$
$X = 1.08k+1.11z+1.08E-1.00C+1.3L$
$W = -0.06k-0.01z-0.06E+1.7L$
$F = 1050k+1540z+1040E+18{,}100L$

HIGH BACK-PRESSURE—FIG. 1C

$x = 1.07k+1.17z+1.06E+3.3L$
$X = 1.10k+1.11z+1.10E-1.00C+0.3L$
$W =$ nil.
$F = 1470k+1610z+1460E+4490L$

where:

x = boiler load in lb./hr.
X = treated make-up water in lb./hr.
W = cooling water in gpm.
F = fuel in Btu./hr.
P = purchased power in kwhr.
E = 15-lb. steam to process, lb./hr.
L = load in kw.
k = 150-psig. process steam, lb./hr.
z = high pressure process steam, lb./hr.
h = hours of annual operation
C = condensate return, lb./hr.

INVESTMENT COST

In the foregoing paragraphs equations were discussed which determine the size of boilers, cooling and make-up water that would be required to serve a steam turbine.

Shortcuts may be used to expedite the economic study, although most operating companies have their own systems for preparing cost estimates. For example, if costs of similar installations are available, they may be prorated for the present purposes. It is well known that investment costs do not vary linearly with capacity. A general cost equation, however, may be written such as:

$$I = I_o\ (C/C_o)^y \quad \ldots\ldots\ldots\ldots (1)$$

In this equation, I = the investment cost for the new plant and I_o is the base cost being used from similar installations, C is the capacity of the present plant, and C_o is the capacity of the comparative or basic plant. The exponent y varies somewhat with the type of installation. However, from a large number of comparisons it can be shown that the proration exponent for most installations is equal to 0.6 as a minimum and typical for electrical installations, and may be as high as 0.8 for boiler plant installations.

The capacity C is derived, for each facility from the heat balance. The value determined, however, must be adjusted for both of the following factors: spare capacity and commercially available sizes.

The desirability of spare capacity has long been the subject of management discussion. The conflicting factors are low investment and continuity of operation. On the basis that spare capacity will be provided, the cost equation can yield some interesting information.

Consider that one machine of a group will be designated as the spare unit. The amount of spare capacity may be 100% (two machines, one is a spare) 50% (three machines) and so on. Substitute for C in Equation (1) its equivalent NR, where N is the number of machines of rating R. Differentiate and equate to zero:

$$dI/dN = 0 \quad \ldots\ldots\ldots\ldots (2)$$

and, solving for N can be shown to result as:

$$N = 1/(1-y) \quad \ldots\ldots\ldots\ldots (3)$$

this being the equation for the optimum number of machines for minimum investment cost.

Obviously, there is some latitude in the values assigned to the proration exponent y, for N physically must be a whole number. For values of y in the range of 0.5 to 0.6, N becomes 2, and in the range 0.6 to 0.7 the optimum number of machines is 3.

Examination of the cost of recent installations will aid in assigning an appropriate value. These should be adjusted to a common base location and construction year.

OPERATING COST

The usual operating costs may be tabulated as follows:

a. Fuel and/or purchased power cost.
b. Maintenance (materials and labor).
c. Operating labor.
d. Supervision.
e. Depreciation.
f. Taxes (excluding income taxes).
g. Indirects.

The heat balance would be the source of fuel requirements for the determination of fuel cost and/or purchased power cost.

Maintenance materials and labor costs are often-times unobtainable. Lacking better information and for the purposes of this comparison, this item may be taken as 1.5% of the investment cost.

Operating labor will be determined largely by local circumstances; first, as to the number of operators required and, secondly, their wage rate.

The factor of supervision and administration should not be overlooked and, lacking a better figure, may be taken as 25% of the operating labor cost.

Depreciation is a factor that may or may not be under the control of the operation company. Certain depreciation rates have been specified by the Internal Revenue Code, and these should be used in these studies.

Under the item of "Taxes," it is intended that only real estate and similar taxes be considered, 1% of the investment cost is considered adequate for study purposes. Income taxes will be discussed later in the section on Economic Comparison.

"Indirects" come in two categories: those associated with supporting services, i.e., laboratories, offices and similar items; and those associated with payrolls, i.e., pension plans, insurance and benefits to mention some. Each operating company will have its own figure for these. Those associated with facilities will range from 25% to 50% of all labor, maintenance and supplies. Similarly payroll items will probably range from 25% to 35% of all labor.

THE ECONOMIC COMPARISON

Two cases can be compared at this point. By this time there will be at least two different investment costs, there being one for each case being investigated. There will also be a separate operating cost for each case. One case should be used as the basis of comparison. It is quite usual to select this case as being the one with the smallest investment cost. It is usual that this case will have an operating cost somewhat higher than a case with a higher investment cost. The comparison can be made most easily by applying investment and operating

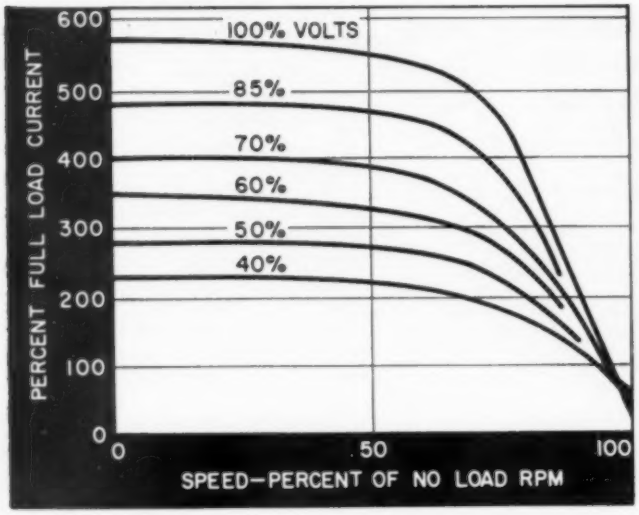


FIG. 2—Starting current vs. speed (% motor volts as parameter)

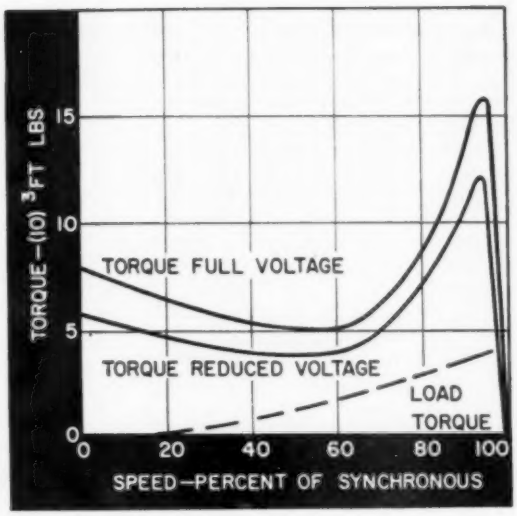


FIG. 3—Torque speed curves

costs to the following equation:

$Y = \Delta I / \Delta E$, or

$P = (\Delta E / \Delta I)\ 100$ . . . . . (4)

where: P = % return on added investment (gross).

Y = years to pay out added investment (gross).

I = difference in the investments.

E = difference in annual operating costs.

The gross return does not represent the return actually realized. It is now necessary to consider income taxes. In many large operations, this income tax item may reduce the gross return by as much as one half and double the payout time. With the net return now calculated, the engineer generally steps aside while management determines whether or not the particular return is one in which the owners would be interested.

The point has been reached at which a decision as to the type of drive will be made. This paper is primarily interested in the case where electric drives are selected. Therefore, we will proceed on the basis that an electric motor has been selected.

2—Engineering the Application

SELECTION OF MOTOR TYPE

The selection of motor type—squirrel cage induction, wound rotor induction, or synchronous—can become a controversial issue. The authors intend to maintain a firm neutral position while discussing the factors that lead to a conclusion. The discussion dwells more on squirrel cage motors as the record indicates these to be most widely used.

The factors involved are cost (including the factors of enclosure type), load inertia, system capacity, and maintenance. The cost spoken of here is that used previously in the economic comparison and it is assumed that the motor type was selected prior to making the economic comparison.

Load inertia should be scrutinized carefully. Most engineers will be familiar with the usual motor-driven pump as it is applied in the process industries. In that type of application, the motor will represent at least 80% of the total inertia of pump and motor combined.

The reverse is the case in most of the large applications of motors under discussion here. For example, one of the motors used as background data for this paper had a rotational moment of inertia (WR^2) of 2600 lb.-ft.^{2} The load WR^2 was equal to 13,000 lb.-ft.^{2}

It will be necessary to determine acceleration time in almost every application. In the conventional motor-driven pump application, it usually is sufficient to check the voltage drop at the instant of starting. In these large motor applications, the inertia is high enough that long acceleration times result. Acceleration times of 20 to 30 seconds are not unusual.

The wound rotor induction motor has long been associated with high inertia drives. This motor is difficult to apply in hazardous atmospheres due to the slip-ring construction. Generally, it is impractical to build a wound rotor explosion-proof motor.

There remains, therefore, the induction motor and the synchronous motor. There are factors favoring both types of motor. The squirrel cage induction motor has in its favor simplicity of motor and control, as well as high values of starting torque. The synchronous motor has in its favor higher efficiency and power factor. The synchronous motor is also favored with low values of inrush current which are of advantage on systems of low interrupting duty.

SELECTING MOTOR VOLTAGE

Motors of the type being discussed are available in 2400, 4160, and 13,200-volt classifications. From a straight cost point of view, and in sizes up to 5000 hp., it is more economical to select 2400 or 4160 volts. Above about 5000 hp., switchgear limitations will make it necessary to use motors wound for 13,200-volt operation.

Even in the smaller sizes, that is, more than 3000 but less than 5000 hp., it may be desirable to select 13,200 volts. The reason for this is that the motor being wound for the higher voltage is applied further back in the power distribution system at a point where the reliability is probably greater. Intermediate switching and transformation is eliminated.

THE STARTING PROBLEM

One of the most difficult parts of the application problem comes in starting the motor. During the period beginning with the motor's connection to the system and ending when it has been accelerated to full speed the system undergoes a shock approaching that of a minor short circuit. Though the motor itself is subjected to a period of stress greater than that occurring during full load operation, it is less

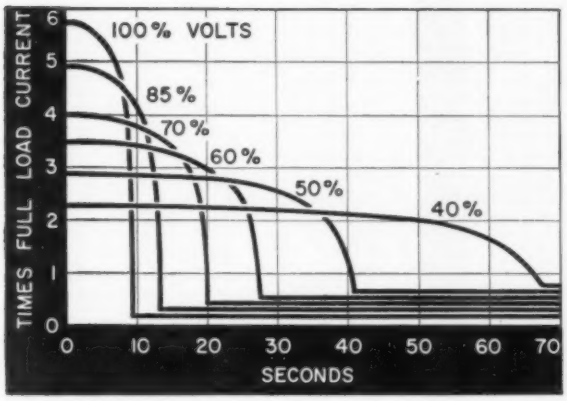


FIG. 4—Current vs. time (motor terminal volts as parameter)

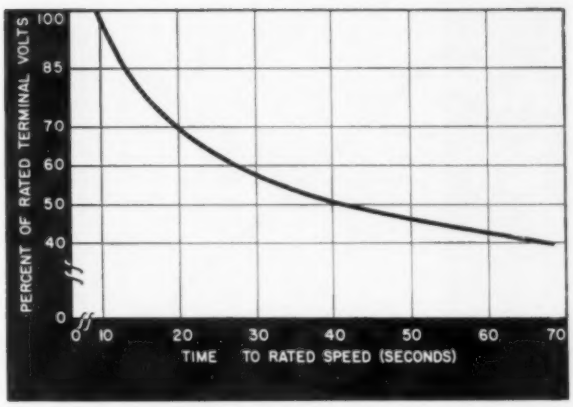


FIG. 5—Effect of voltage on acceleration time

severely stressed than its supply system.

A common misconception exists in thinking that reduced voltage starting goes with the application of large motors. Generally speaking when large motor starting requires reduced voltage it is because the supply system cannot tolerate the voltage dip at the instant of starting.

A quick check of the voltage dip can be made thusly:

$$V_d = (I_i\ Ep\ \sqrt{3})\ 1000 \text{ kva.}$$

where I_i is the full voltage inrush current; E is the system volts (ϕ to ϕ); p, percent volts of starter (full voltage, across the line = 100%); kva, short circuit level of system at motor terminals; V_d, the % voltage dip at motor.

Depending upon the part of the system in which the motor is located, other users, and regulations of the local supplier; the allowable V_d will range from 5% to 20%. Fig. 2 shows how the motor current usually varies with speed for various terminal volts.

The lower values of voltage are to be avoided for reasons of acceleration time. Fig. 3 shows a typical torque speed curve for a squirrel cage induction motor driving a centrifugal machine. The torque available for acceleration is the difference between motor torque and load torque. Note that the motor torque varies as the voltage squared.

A good approximation[1] of the time can be obtained by the step by step integration of the equation:

$$\Delta t = [3.25(10)^{-3}\ (Wr^2)\ (N_2 - N_1)]/\Delta T \quad \ldots\ldots\ldots\ldots\ldots (4)$$

where: Δt = incremental acceleration time, seconds.

Wr^2 = rotational moment of inertia.

$(N_2 - N_1)$ = change in speed.

ΔT = torque available for acceleration, lb.-ft.

As the terminal voltage during starting is reduced, the starting time increases, as shown in Fig. 4. Here it can be seen that the acceleration time is very nearly inversely proportional to the terminal voltage squared. Fig. 5 summarizes this conclusion.

The motor terminal current shown in Fig. 4 does not give the complete story. The energy fed to the motor has a time factor too. Some of this energy is delivered to the load as useful work while the remainder appears as either heat energy or stored energy.

A heat balance around the motor may be written as:

Energy input = Energy Output + Stored Energy ..... (5)

Each of these terms will be examined separately. Energy can be expressed in terms of watt-seconds or British thermal units. The equations used herein are all in Btu.

ENERGY INPUT

The energy input to the motor in general terms is given by:

$$E_i = \sum_0^{\text{run}} (iE\sqrt{3}\ \cos.\phi s/1056) \ldots\ldots (6)$$

where i is the terminal current at various times as shown in Fig. 4 and s the time in seconds for the interval over which i is averaged. If the current time curve similar to Fig. 4 is prepared on cross section paper it is a simple matter to obtain an average current during the starting interval by inspection.

Following this averaging procedure the energy input equation may be greatly simplified to the following:

$$E_i = 0.0016\ IE \cos\phi\ S \ldots\ldots (7)$$

where I is the average current over the starting interval, E the terminal volts, $\cos\phi$ from Fig. 6 and S the starting interval in seconds.

The power factor during starting, $\cos\phi$, is a small fraction of its value at full load and full speed. For an accurate analysis a curve of power factor and motor speed would be required. However, for demonstration purposes an average power factor as shown in Fig. 6 will suffice.

ENERGY OUTPUT

The output can be broken into: (1) energy to load, (2) radiation of heat, and (3) friction and windage losses.

The interval of time under consideration is short enough that radiation may be neglected. For example, the heat radiated from the surface of the motor is at the rate of 8 to 10 Btu/hr./sq. ft. of outside surface/° F. For a 3000-hp. motor, it is only 170 Btu in a 20-second starting period, if the surface is 100° F. over the ambient. This is small compared to a total input of about 35,000 Btu.

For values of terminal voltage above 80% the friction and windage losses can also be neglected. These losses generally are less than 10% of the total energy for the higher values of terminal voltage.

The energy delivered to the load in Btu can be estimated from the following:

$$E_d = 135\ (10)^{-6}\ TNS \ldots\ldots (8)$$

The torque T is the average torque over the starting period S in seconds, read from the torque speed curve of the load (Fig. 3). N is the full load speed of the load.

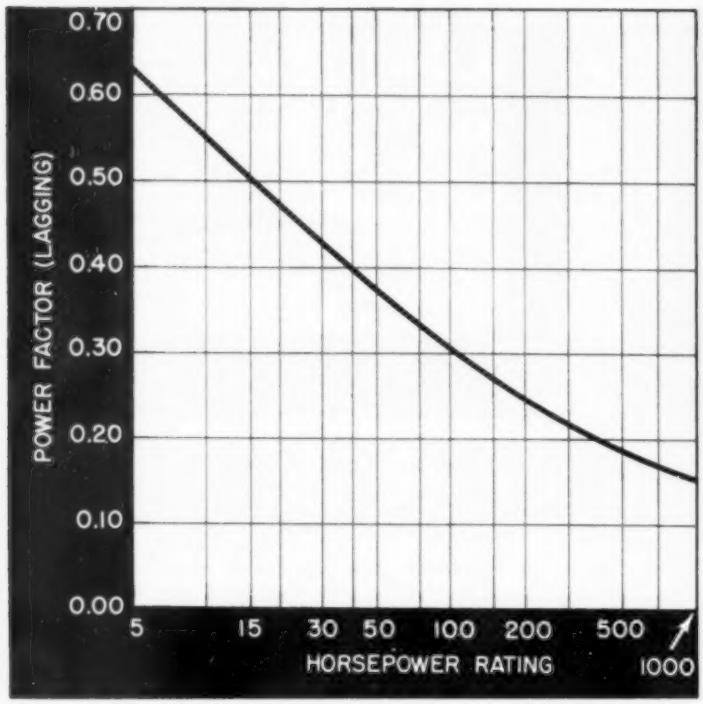
STORED ENERGY

The energy stored in the system is in two forms: (1) rotational energy and (2) heat energy.

The rotational energy may be expressed as:

$$E_r = 0.219\ (10)^{-6}\ (Wr^2)\ N^2 \ldots (9)$$

where (Wr^2) is the rotational movement of inertia of both the motor and its load referred to the motor speed, and



from General Electric Industrial Power Systems Data Book

FIG. 6—Approximate starting power factor of typical squirrel-cage induction motors

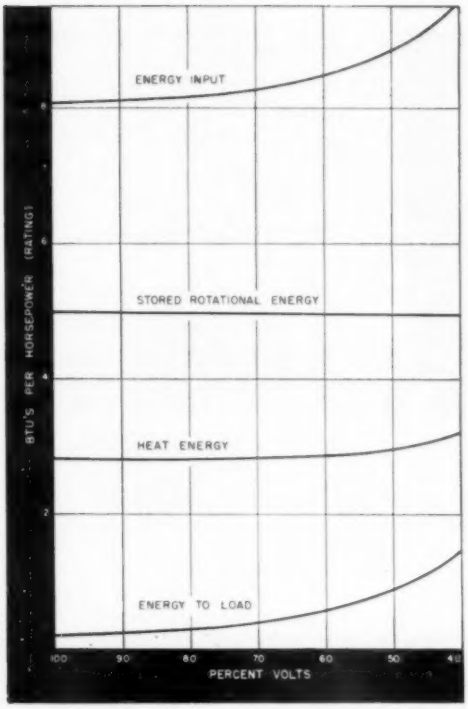


FIG. 7—Effect of terminal voltage on energy distribution

N is full speed in rpm. A speed increaser to drive the load at greater than motor speed will act as an inertia multiplier when referring load Wr^2 to motor speed. The multiplier is a factor equal to the square of the speed ratio, i.e. (load rpm/motor rpm)^2.

HEAT ENERGY, TEMPERATURE

All of the terms of the motor heat balance Equation (5) have been specifically evaluated except that for "heat energy," E_h. Recapitulating;

$$E_i = E_d + E_r + E_h \quad \ldots\ldots (10)$$

or solving for E_h to obtain this term by difference,

$$E_h = E_i - E_d - E_r \quad \ldots\ldots (11)$$

The "heat energy" may be expressed another way, in terms of the specific heat of the construction materials of the motor; that is:

$$E_h = q\ W\ \Delta\ F \quad \ldots\ldots\ldots\ldots (12)$$

where q is in Btu/lb./° F., or 0.1058 Btu/lb./° F. for iron and steel; W is in lbs.; and $\Delta\ F$ is temperature differential. $\Delta\ F$ can be written $F_m - F_a = \Delta\ F$, where F_m is motor composite temperature and F_a is the ambient temperature. From this E_h can be written:

$$E_h = q\ W\ (F_m - F_a) \quad \ldots\ldots (13)$$

which yields a solution for the motor composite temperature at the end of the starting period.

It should be remembered, however, that from 65% to 75% of this energy is released within an inch or two of the surface of the rotor. Use of this reduced heat quantity and the rotor weight will give an approximation of the rotor temperature.

This energy in the rotor will be transferred across the air gap and thence to stator and to the ambient air at a relatively slow rate. This rate will be about 8 to 10 Btu/hr./sq. ft. of surface/° F. differential if the motor is running. If the motor is stopped immediately after starting, this rate will be reduced to about 25% of the running figure.

The mass of the rotor will be heated quickly as the heat transfer rate through the metal is many times that through the air gap. However, during this heating period high differential temperatures will be developed between the rotor bars and the end ring. These differential temperatures will, if high enough cause cracking of the end ring connections.

EFFECT OF TERMINAL VOLTAGE

The foregoing paragraphs have indicated methods for determining the various energy components. A good picture of how they are affected by motor terminal voltage is shown in Fig. 7. These curves were obtained by applying the various energy equations as given.

Note that both "total energy," and even more important "heat energy," increase as motor terminal voltage is decreased through reduced voltage starting. From Equation (13); it can be seen that, as E_h increases F_m will also increase, it being the only other variable. The rotor temperature can have a serious effect on stator winding insulation.

A good idea of the limits involved can be had from Table 2. Life expectancy halves for each 8° C. to 10° C. increase in continuous temperature. That is, for example; if Class A insulation is operated at 115° C. continuously, its life expectancy is 3.5 years.

3—Protecting the Motor

Because of the reliability of service demanded of a prime mover in the refining industry, adequate protection should be provided to prevent damage to the motor and to minimize downtime because of abnormal conditions.

If a motor is provided with liquid cooling, suitable precautions should be taken to guarantee the uninterrupted flow of the coolant. Loss of the coolant will result in excessive motor temperature which can be damaging. If the motor temperature rises to an abnor-

mally high value, the motor should be disconnected from the supply automatically.

Since the temperature rise will lag the loss of coolant, an alarm should be provided on the cooling system to warn of a stoppage in coolant flow. The rate of rise of temperature upon loss of coolant is a few degrees per minute and some time will remain between the sounding of the alarm indicating loss of coolant flow and the reaching of a high temperature. It may be possible, if sufficient time exists, for an operator to correct the coolant trouble and prevent the motor from being shut down because of an automatic trip due to excessive temperature.

Overcurrent protection provided for the motor should give protection against sustained overloads as well as short-circuits. A sustained overload will cause the motor to draw excessive current which is reflected in increased motor temperature. Providing a thermal overload device will result in adequate protection from sustained overloads.

An induction type time delay overcurrent relay with an instantaneous attachment will provide protection against severe overloads and short-circuits. It is important that overload relays be very carefully selected so that they can be properly coordinated with the motor characteristics. Plotting the starting current (Fig. 4) on the relay coordination curve sheet is advisable.[2]

Undervoltage relays are applied to large motors for two reasons. The first and more apparent is the protection they provide the motor against low voltage conditions. Secondly, using an induction type time delay undervoltage relay, it is possible to select motors that were designed to carry through abnormal voltage conditions and allow other motors to be disconnected from the power source. At the same time, if the abnormal voltage condition persists longer than a predetermined time, all motors are disconnected from the source.

Single phase relays are provided to prevent unnecessary damage to three phase motors as a result of single phase operation. These relays will disconnect the motor from its power source in the event one phase becomes open-circuited. Eventually the motor circuit breaker would trip on overcurrent or excessive temperature but the single phase relay obviates awaiting for an overcurrent or excessive temperature to be reached.

Reverse phase relays will trip the motor circuit breaker if the power supply phases are reversed for any reason preventing reversed rotation. This protection is necessary because quite frequently large centrifugal machines are built to take thrust in one direction only. Severe damage to the machine will result if reversed rotation is permitted.

Generally, a large unit is lubricated from a central pressurized lubricating oil system. It is necessary to start the flow of oil through the system prior to motor starting and to permit the flow to continue for a period of time after the unit has been shut down. On some units loss of lubricating oil pressure does not call for an immediate shutdown. Because of the oil holdup in bearing wells, it is possible to operate for a limited time while an attempt is made to correct the trouble.

Table 2—Insulation Life Expectancy

Class	Oper. Temp.	Life, years
A	105° C.	7
B	130° C.	7
H	220° C.	7
H	180° C.	60

4—Operating the Motor

During the design stage of a power system from which a large motor is to be served, it is necessary to have an idea of the expected voltage drop and accelerating time of the motor-driven unit. The manufacturers of the driven unit and the motor driver can furnish the necessary information to permit calculation of the voltage drop and accelerating time. These calculated values will provide the basis for the design of the power supply and will permit the power supplier to provide suitable equipment to tolerate any unusual conditions because of the large motors.

When the units have been installed, and prior to putting them in service, arrangements should be made to conduct tests so that the actual motor operating characteristics can be determined.

If it is planned to operate the motor from a secondary selective system with automatic transfer and the motor is to be carried through the transfer and allowed to reaccelerate upon completion of the transfer, a test should be conducted on this phase of operation also.

From oscillograph records made during these tests data regarding voltages, currents and time can be obtained which is useful in checking the design and application.

Routine motor operation is greatly simplified by the use of proper instrumentation and protective equipment. Alarms on the cooling system and lubricating oil system; automatic trip because of sustained overloads resulting in excessive temperature, severe overloads, short-circuits and sustained low voltage conditions; and the continuity of service gained by automatic transfer in the secondary selective system are features which will give a unit operator confidence in the motor-driven equipment. By regularly observing bearing and winding temperatures and motor current, the operator can keep a close watch on the motor operation.

References

(1) "Problems Confronting the Designer in Starting Large Motors," by C. M. Lathrop and C. E. Schleckser, American Institute of Electrical Engineers *Transactions*, T1-251.

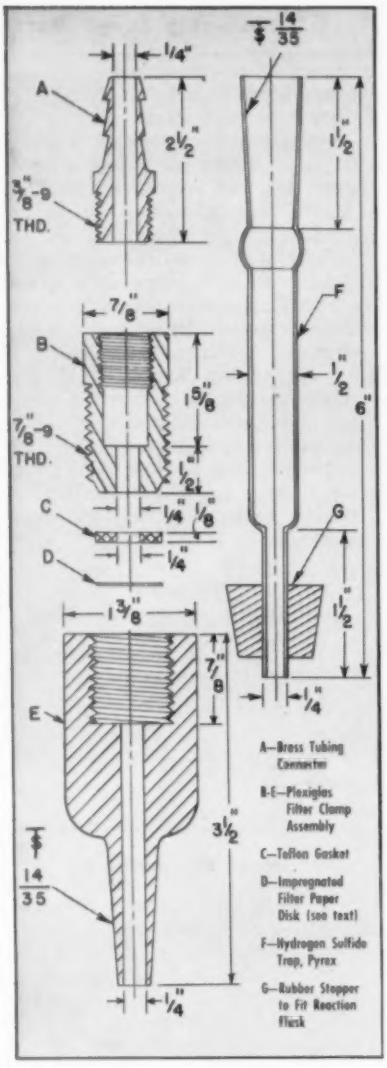
(2) "Protective Relaying on Industrial Power Systems," by C. M. Lathrop and C. E. Schleckser, American Institute of Electrical Engineers *Transactions*, T1-248.

Meet the Authors

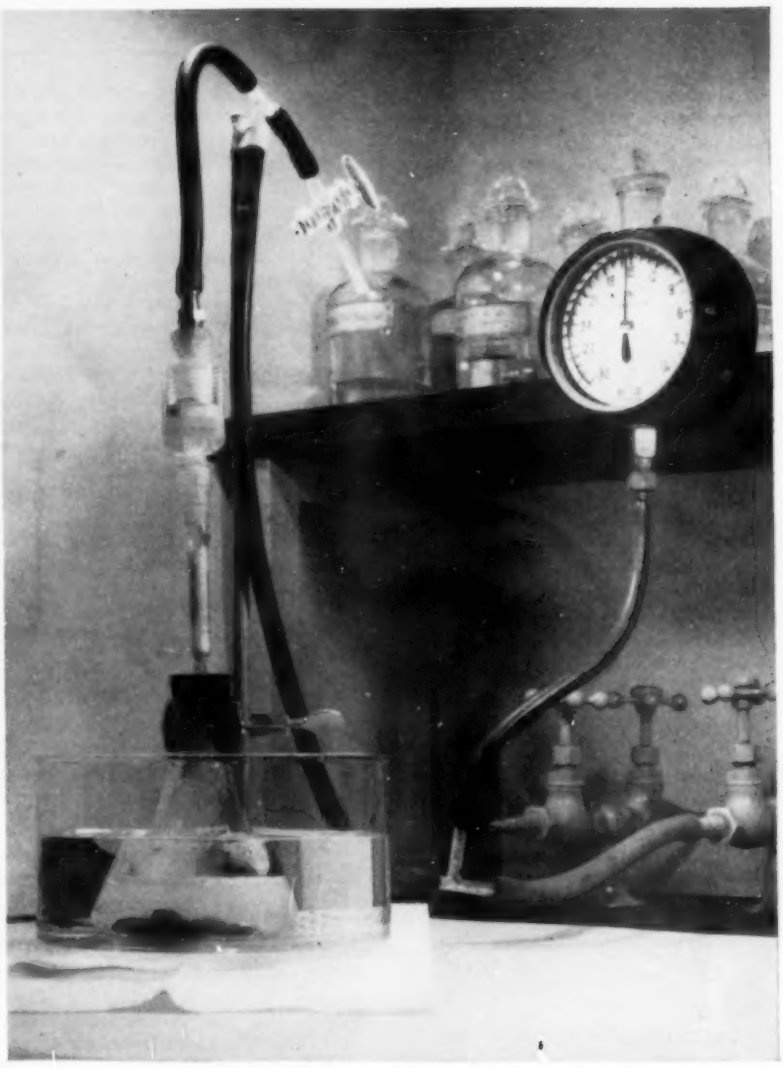
Mr. Lathrop Mr. Winsor

Carl M. Lathrop, an assistant supervising engineer in the Esso Engineering Department of Standard Oil Development Co., is a 1937 graduate in electrical engineering from Rensselaer Polytechnic Institute. At present, he is a member of the Central Radio Committee of American Petroleum Institute, chairman of the Refinery Use-of-Radio Committee of the API, and a member of the Committee on Industrial Power Distribution of the American Institute of Electrical Engineers.

Edward J. Winsor, an engineer in the same department with Mr. Lathrop, became associated with Standard Oil Development Co. in 1951. He was graduated from Rensselaer with a B.S. in electrical engineering.



DETAILS OF CONSTRUCTION of equipment



RELATIVELY SIMPLE APPARATUS is required for new micromethod for arsenic.

HOW TO DETERMINE
Arsenic Traces in Oil or Catalyst

By RAYMOND R. JAY and LESTER R. DICKSON
Sinclair Research Laboratories, Inc.

A SUCCESSFUL method has been developed and put into use at the Sinclair Research Laboratories for determining very minute quantities of arsenic in petroleum fractions. It may also be applied readily to catalyst materials and similar substances.

It may be used for analyzing samples containing as little as 2 to 4 parts per billion (ppb) of arsenic. The weight of the sample taken may be up to 25 to 50 grams, but it should be such as to contain from 0.1 to 1.0 micrograms of elemental arsenic.

The method was developed as a result of investigation of certain reforming processes, because it was desirable to ascertain the effect on the catalysts of trace quantities of various elements contained in the feed stocks used in these processes, among them arsenic. A literature survey indicated no satisfactory method was available for determining ultramicro quantities of arsenic in petroleum fractions.

The new technique is based upon the ultimate conversion of arsenic to arsine by reduction with metallic zinc in an acid solution:

$$6H^+ + 3Zn + 3H_3AsO_3 = AsH_3 + 3Zn^{++} + 3H_2O$$

The arsine thus formed is absorbed on a filter paper impregnated with mercuric bromide, giving a yellow stain proportional to the weight of the arsine absorbed.

The usual standard Gutzeit filter strip method, as for example that given by the Association of Official Agricultural Chemists[1], is not applicable to quantities of arsenic below a few

micrograms. Satterlee and Blodgett[2] described an ultramicrodetermination of arsenic by a Gutzeit filtration under vacuum. However, this method was developed for biological specimens and the like, and is not applicable to petroleum products. The present method is a modification of this latter procedure to include petroleum products.

The yellow arsenic stains may be converted to a somewhat more intense grayish color by treatment with a drop or two of an alcoholic ammonia solution. However, this technique proved unreliable for stains obtained from petroleum products carried through the wet oxidation procedure to be described herein.

An interfering substance frequently resulted from the oxidation of organic matter, which produced a dark color on treatment with the alcoholic ammonia solution. The nature of this interference has not been determined. Nevertheless, satisfactory results may be obtained by direct comparison of the original yellow stains without the ammoniacal treatment.

The very low concentrations of arsenic to be determined in petroleum fractions require the use of large samples (25 to 50 gm.). It seemed that an extraction procedure might be a convenient method of obtaining the arsenic in an aqueous solution suitable for the evolution of arsine. However, extraction with various concentrations of hydrochloric and sulfuric acid failed to give satisfactory recoveries of arsenic added in the form of triphenylarsine.

Investigation of typical naphthas showed that essentially all of the arsenic present was retained in the bottoms when a sample was subjected to distillation (see Table 1). This led to the development of the new procedure, which combines extraction with nitric and sulfuric acid mixtures, partial distillation of the lighter fractions, and finally complete wet oxidation of the residue. Typical results are in Table 2.

Apparatus required for the new technique is as follows:

1—Vacuum pump, or other source of vacuum, capable of producing a working pressure of 0.5 atmosphere.

2—Vacuum gage.

3—Erlenmeyer reaction flasks, 250 or 300 ml. in size, fitted with one-hole rubber stoppers.

4—Spot-test vacuum filtration apparatus and hydrogen sulfide trap as shown in the accompanying drawing. This is a modification of the apparatus of Satterlee and Blodgett.

5—Kjeldahl flask, 300-ml., with standard taper joint, 19/38.

6—Water condenser with 19/38 joint.

7—Graduates, 25 and 100 ml. size.

8—Apparatus for making electrolytic zinc. A suggested assembly consists of a 6 to 10-volt rectifier, two flat platinum gauze electrodes approximately 3½ in. square, a battery jar 3¾ x 3¾ x 8 in. deep, and an electric stirrer.

9—Safety glass shield. The wet oxidation procedure is carried out behind this shield.

10—Filter disks, Whatman No. 50 filters cut into disks of approximately ⅝-in. diameter. A supply of disks, enough for a week or so, is placed in a jar fitted with a one-hole rubber stopper and submerged in an alcoholic mercuric bromide solution (see "Reagents"). A vacuum of about ½ atm. is applied for about an hour. The vacuum is then removed and the disks are stored in an amber-colored jar or wide-mouthed bottle, tightly stoppered. Just before use, a disk is removed from the bottle, blotted quickly between filter papers, air dried, and used promptly.

Reagents used in the method are:

Zinc, Bakers' Analyzed. This may not be suitable for use directly because it may yield high blank values. The most accurate and reliable results require electrolytically purified zinc. However, if the highest accuracy in the low ranges is not essential, it may be possible to use the zinc as supplied by the manufacturer. This may be the case if a grade of zinc is available which gives a blank substantially lighter in color than the 0.1 gamma, or lowest required standard.

Zinc is purified by dissolving in hydrochloric acid to form a strong, acid-free zinc chloride solution. This solution is electrolyzed between platinum electrodes so as to form pure arsenic-free zinc at the cathode. This cathodic zinc is collected, washed, dried, and used for all subsequent determinations.

Sulfuric Acid, C. P., du Pont. Rated as having a maximum limit of impurity for arsenic as 0.000000%, this acid should be removed from the manufacturer's bottle and placed in a 500-ml. pyrex bottle, glass stoppered.

Sulfuric Acid, dilute (1:1). Dilute the CP acid described above, add about two gm. of electrolytic zinc per liter of diluted acid, and heat to the boiling point after all the zinc has dissolved. This treated acid is used for determining the purity of the electrolytic zinc.

Nitric Acid, C. P., du Pont. Rated as having a maximum limit of impurity for arsenic of 0.000000%, this acid should be stored in 500-ml. pyrex bottles after opening.

Hydrogen Peroxide, C. P. 30%, Baker's Analyzed Reagent.

Potassium Iodide Solution. A 15% solution of CP potassium iodide in distilled water.

Stannous Chloride Solution. A 40% solution of stannous chloride dihydrate, arsenic-free, in hydrochloric acid.

Lead Acetate Solution, 10 gm. of lead acetate trihydrate in 90 ml. of distilled water, made acid to litmus with acetic acid and then made up to 100 ml. of volume.

Quartz, granular, about 20 mesh.

Pyrex Wool.

Mercuric Bromide Solution. A 5% solution of CP mercuric bromide in 95% ethyl alcohol. (This solution is used for sensitizing the filtration spot test papers.)

Standard Arsenic Solution. Prepare this solution by dissolving 1.3204 gm. of As_2O_3 in 25 ml. of a 20% arsenic-free sodium hydroxide solution, saturated with carbon dioxide, and diluting with distilled water to 1000 ml. This solution contains 1 mg. Arsenic per ml. Dilute further to make a solution containing 1 microgram As/ml.

Isopropanol, 99% CP.

Ammonium Oxalate Solution. Saturated solution of CP ammonium oxalate.

Procedure: The purity of the reagents should be checked before a test is started. This blank is especially indicative of the purity of the electrolytic zinc since this is the reagent most likely to contain the arsenic.

Prepare the hydrogen sulfide trap by pouring in about 1½ in. layer of granular quartz, held in place by pyrex wool plugs. Pour a little of the lead

Table 1—Arsenic Contents from Distilled Naphthas

Sample	Arsenic, ppb. 90% Overhead	Arsenic, ppb. 10% Bottoms
1	10	175
2	<4	40
3	<2	25

Table 2—Typical Results

Sample	Arsenic, ppb.
Kerosene[a]	36, 44
Naphtha[b]	1160
Used catalyst	180,000; 200,000
Naphtha	<4, <4
Bottoms, 350-400° F.	980

[a] 40 ppb. arsenic added as $(C_6H_5)_3As$

[b] 1000 ppb. arsenic added as $(C_6H_5)_3As$

acetate solution through the trap so as to saturate the quartz granules. Draw off the excess solution with gentle suction.

Prepare the Erlenmeyer reaction flask by adding, in the order named: 35 ml. of distilled water; 25 ml. of dilute (1:1) zinc-treated sulfuric acid; 40 ml. of isopropanol; 5 ml. of potassum iodide solution, and 5 to 7 drops of stannous chloride. Allow this to stand for about 10 minutes.

The use of isopropanol is to slow down the rate of hydrogen evolution when finely-divided zinc is used. The amount used may vary with the individual needs. The volume of solution is then adjusted to about 100 ml. with distilled water. In case mossy zinc has been used, the isopropanol is eliminated entirely.

Place a dried filter disk under the Teflon gasket and assemble the apparatus as indicated in the drawing. Connect to a suitable vacuum system including a gage and a bleeder for regulating the pressure. Weigh 4.0 gm. of electrolytic zinc, turn on the vacuum, adjust to 0.5 atm., drop the zinc into the reaction flask, and quickly fit in the rubber stopper attached to the hydrogen sulfide trap. Place the flask in a water bath at room temperature, and allow the reaction to proceed for 30 minutes. The reaction should proceed fairly rapidly and smoothly.

Turn off the vacuum and remove the filter disk. There should be no visible yellow stain at this point.

Stains are calibrated by using the standard arsenic solution. The desired amount of standard arsenic solution is pipetted into the reaction flask prepared as outlined just above in the procedure for a blank. In general, this ¼-in. stain will be useful over the range, 0.1 to 1.0 gamma of arsenic.

The yellow stains produced are not stable for more than a few hours. They should be preserved between slide glasses and kept in the dark except when actually being used for comparison purposes.

Sample is oxidized as follows. A sample of oil containing 0.1 to 1.0 gamma of arsenic is placed in a 300-ml., glass-jointed Kjeldahl flask and wet ashed by cautious addition of sulfuric acid, nitric acid, and 30% hydrogen peroxide. This operation is done behind a suitable safety shield. The success of the analysis depends upon keeping the volume of acids low. By careful and judicious additions of acids and peroxide, it has been found possible, generally, to wet ash a 25-gm. sample with 25 ml. of nitric acid, 20 ml. of sulfuric acid, and about 40 ml. of hydrogen peroxide.

It is impossible to describe completely the art of wet oxidation because of the diversity of sample types and other factors. However, the following comments may be of value:

The sulfuric acid (20 ml.) is added to the sample and shaken. Then about 5 ml. of nitric acid is added cautiously. If the sample is volatile, a water condenser is used at this point. If no appreciable reaction occurs, heating is begun. Small increments of nitric acid is continued so as to react progressively with the sample. If a condenser is used, it is removed after the sample has been refluxed for an hour or so with the nitric-sulfuric acid mixture. Wet ashing is then continued.

In arsenic analysis, it is not advisable to allow the formation of much coke during the oxidation, because of the possibility of volatilization of reduced-valence arsenic compounds.[1]

Therefore, the oxidation is carried to just a very light coking. At this point, hydrogen peroxide is added, a few drops at a time (after partial cooling as indicated below). Generally, a decided lightening in color is observed. The oxidation is completed by successive additions of small quantities of peroxide, heating between additions.

The peroxide has been found to be most effective when added to almost fuming sulfuric acid in the flask. Before the peroxide is added, the heat is removed and the flask allowed to cool somewhat.

Oxidation may be considered complete when the contents of the Kjeldahl flask are colorless or only a very light straw color. At this point, heat strongly to reduce the volume of residual sulfuric acid to 12 ±2 ml.

Then allow the flask and contents to cool nearly to room temperature and then add slowly and cautiously 75 ml. of distilled water and 25 ml. of saturated ammonium oxalate solution, while swirling to mix. Boil to fumes of sulfur trioxide. This treatment assists in removing the last traces of nitrosyl sulfuric acid from the solution.[1]

An oxidation blank should be run on the volumes of reagents used to oxidize the sample, including the ammonium oxalate treatment.

Estimation of arsenic: After the sample has cooled, transfer it to a 100-ml. graduate with distilled water, adjusting the total volume to 55 ml. Add isopropanol to 95 ml. (except where isopropanol was not required as described above), and transfer to the reaction flask.

Add 5 ml. of 15% potassium iodide solution and 5 to 7 drops of stannous chloride solution, and mix. Allow to stand ten minutes. The determination is then conducted as directed previously for running a blank. Note the yellow stain on the filter disk and compare it with a similar stain obtained from a known amount of arsenic run as directed in the section on calibrating the stains. Obtain a stain on the "oxidation blank" in the same manner. This blank should be nearly negligible.

Calculations are run as follows. Arsenic in the sample, in parts per billion is equal to $1000(A - B)/W$, where: A is gammas of arsenic in the sample; B is gammas of arsenic in the oxidation blank; and W is grams of sample taken for the analysis.

References

(1) Official Methods of Analysis of the Association of Official Agricultural Chemists, 7th Edition (1950), page 370.

(2) Satterlee, H. S., and Blodgett, Gertrude, *Ind. Eng. Chem., Anal. Ed.*, 16, 400-7 (1944).

Meet the Authors

Mr. Jay

Mr. Dickson

Raymond R. Jay joined the staff of Sinclair Research Laboratories at Harvey, Ill., after graduation from Illinois Institute of Technology in 1947 with a B.S. in Chemistry. He has been engaged in various capacities in the analytical division, with a major interest in analytical research. He is a member of the American Chemical Society and its Petroleum Section.

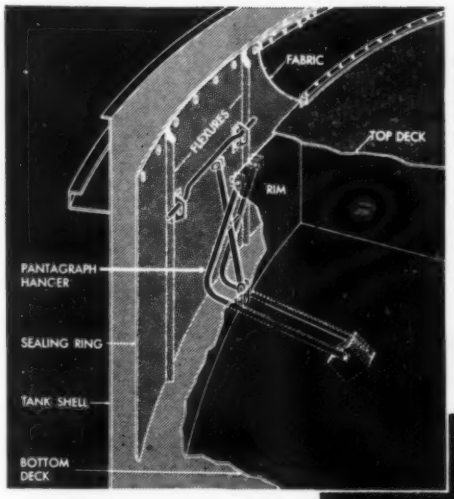
Lester R. Dickson received a B.S. in Chemical Engineering from Wisconsin in 1925. He was associated with Indiana Gas and Electric Co. in various engineering jobs until joining Sinclair as assistant resident chemist of the Coffeyville, Kans., refinery, in 1943. In 1949, Mr. Dickson was transferred to Harvey where he has been active in corrosion. His present assignment is in analytical research. He is also a member of ACS and its Petroleum Section.

STOP EVAPORATION LOSSES From Floating Roof Tanks . . . with the HORTON SEAL

The real secret of Horton® Floating Roof performance is the seal that so effectively closes the space between the deck of the roof and the shell of the tank. Three special features help insure its positive operation. They are: (1) The continuous sealing ring with vertical flexures every 22 inches of circumference that allow it to follow the contour of the tank shell. (2) The pantagraph hangers that hold the sealing ring against the tank shell and keep the roof centered at all times. (3) The gastight, weatherproof, flexible fabric that closes the space between the deck of the roof and the top of the sealing ring making the space in the seal vaportight.

The excellent flexibility of the Horton Sealing Ring, in combination with the gentle push of the pantagraph hangers, provide almost friction-less contact with the tank shell. This reduces wear and gaging errors to a practical minimum and at the same time provides a tight vapor seal around the roof.

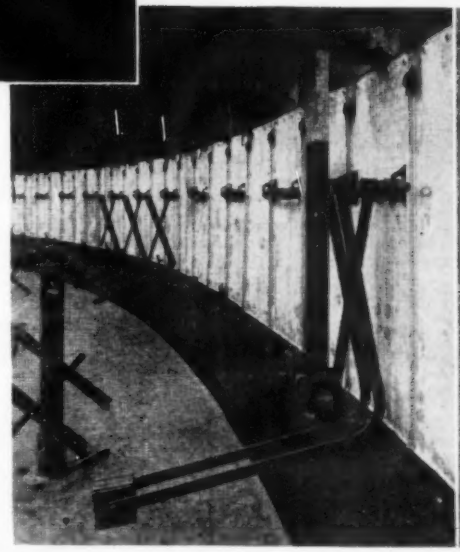
The Horton Seal is standard construction on all Horton Floating Roofs. Write our nearest office for more complete details.



Above: Diagram of a pantagraph hanger showing how it applies a gentle outward pressure at all times on the sealing ring.

Right: View of pantagraph hangers and sealing ring being assembled on an actual roof.

Far Right: Looking down into rim space showing view of hangers and sealing ring in place before fabric is installed.



CHICAGO BRIDGE & IRON COMPANY

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY, and GREENVILLE, PENNSYLVANIA

Atlanta 3	2103 Healey Building	Detroit 26	1532 Lafayette Building	Pittsburgh 19	3236 Alcoa Building
Birmingham 1	1527 North Fiftieth Street	Houston 2	2130 CGI Life Building	Salt Lake City 4	530 West 17th South Street
Boston 10	1029—201 Devonshire Street	Los Angeles 17	1526 General Petroleum Building	San Francisco 4	1559—200 Bush Street
Chicago 4	2114 McCormick Building	New York 6	3310—165 Broadway Building	Seattle 1	1330 Henry Building
Cleveland 15	2215 Midland Building	Philadelphia 3	1630—1700 Walnut St. Building	Tulsa 3	1620 Hunt Building

REPRESENTATIVES AND LICENSEES

Horton Steel Works Limited, Fort Erie, Ontario, Canada
Ateliers et Chantiers de la Seine Maritime, Paris, France
Constructions Metalliques de Provence, Arles-sur-Rhone, France
Chicago Bridge & Iron Company, Ltd., Apartado 1348 Caracas, Venezuela
Compagnia Tecnica Industrie Petroli, Rome, Italy
Whessoe Limited, Darlington, England
Motherwell Bridge & Engineering Company, Limited, Motherwell, Scotland
Comprimo, N. V., 21, Amstel, Amsterdam (C) Netherlands
Sociedade Chibridge de Construcoes Avenida General Justo, 275, Grupo 306, Rio de Janeiro, Brazil

Highly specialized process controls are used to produce the finest in seamless WELDING FITTINGS

Only Globe, among manufacturers of welding fittings, produces its own seamless steel tubes. Specialized processes at every stage of manufacture from billet to tube — to fitting — insure uniform high quality. Thorough inspection and continuous laboratory control guarantee strict conformity to rigid specifications.

Now . . . you can get these high-quality fittings when you need them — in the quantities you want. Just get in touch with your nearest Globe distributor.

GLOBE STEEL TUBES CO., Milwaukee 46, Wisconsin
Chicago • Cleveland • Detroit • New York • Philadelphia • St. Louis
Denver • Houston • San Francisco • Glendale, Cal.

Producers of Globe Welding Fittings — Globe seamless stainless steel tubes — alloy — carbon seamless steel tubes — Gloweld welded stainless steel tubes — Globeiron (high purity ingot iron) seamless tubes.

AVAILABLE IN A COMPLETE LINE OF SIZES AND WEIGHTS THROUGH GLOBE DISTRIBUTORS IN ALL KEY CITIES

Here is one of the highly specialized manufacturing operations that insure Globe quality — piercing the billet to form a seamless tube.

Send for the Globe Welding Fittings catalog.

(To obtain more data on advertised products see page 424)

PETROLEUM PROCESSING

MARCH 1954

Petrochemical Processing Section

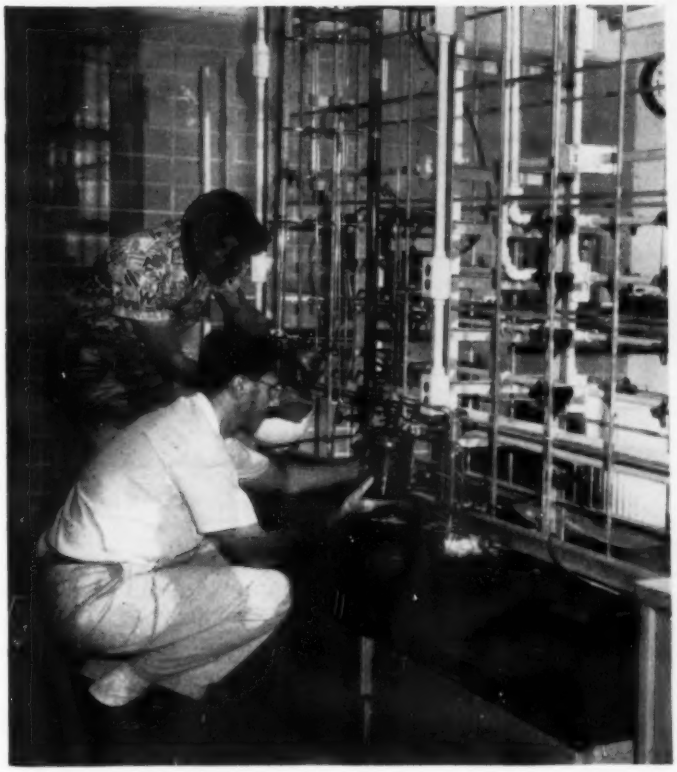
IN THIS SECTION

Petrochemical Storage

How an independent oil terminal helps handle four Shell Chemical Co. products —p. 381

Hydrogen Cyanide

Manufacturing methods and information on petrochemical uses—p. 384



Research in the Southwest

includes accent on petrochemical studies—p. 390

In the Departments

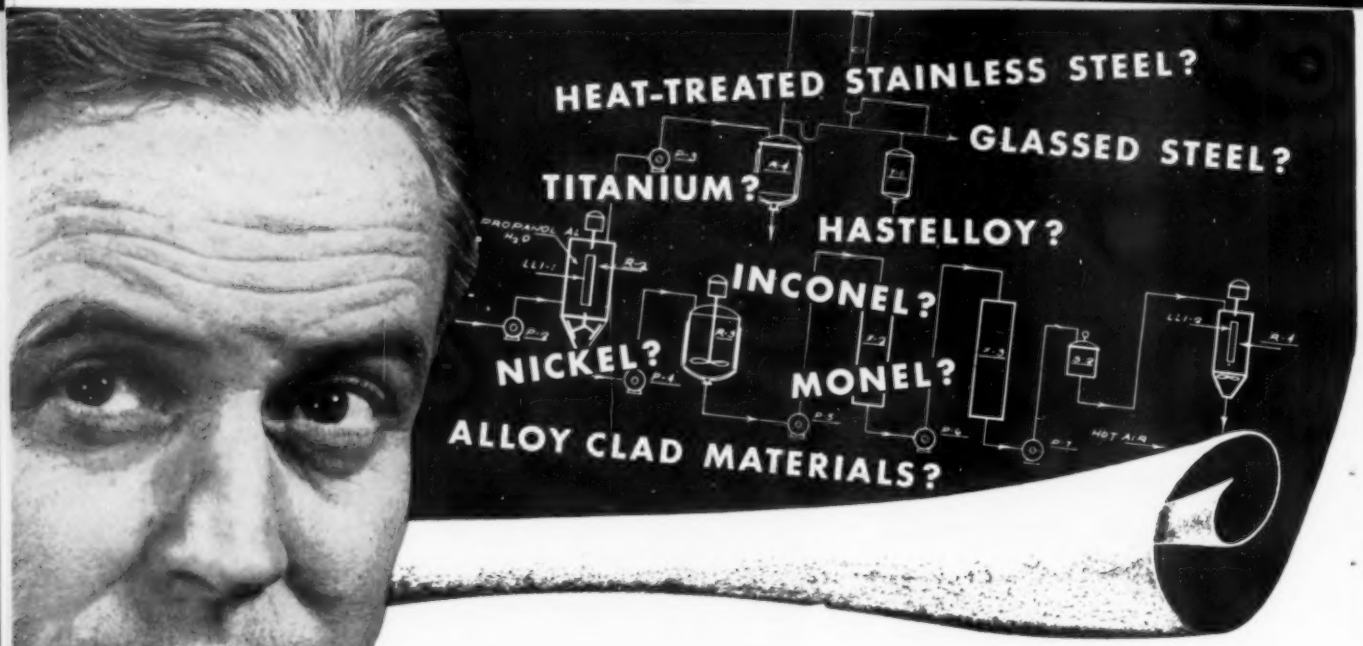
Tips on maintenance of ball bearings for electric motors or pumps—(Plant Practices) p. 393

New magnetically-driven pump shows promise in the handling of hazardous fluids—(What's New) p. 425

Imports of crude oil are essential to assure supplies when we need them—(Editorials) p. 448

OTHER DEPARTMENTS

Laboratory Practices 397
Patents 401
Suppliers 409
Personals 413
Meetings 419
Information Offered 422
Advertisers' Index 424



What does Pfaudler corrosioneering offer you?

Improper selection of materials of construction can cause all kinds of trouble . . . rapid corrosion of equipment, poor yields, product contamination, to mention a few. Result? Red figures!

No one wants to be involved in such an error. But mistakes can easily occur—through haste, misguided attempts at economy, or plain lack of experience. And with so many materials available, selection of the best is a more complex problem than ever before.

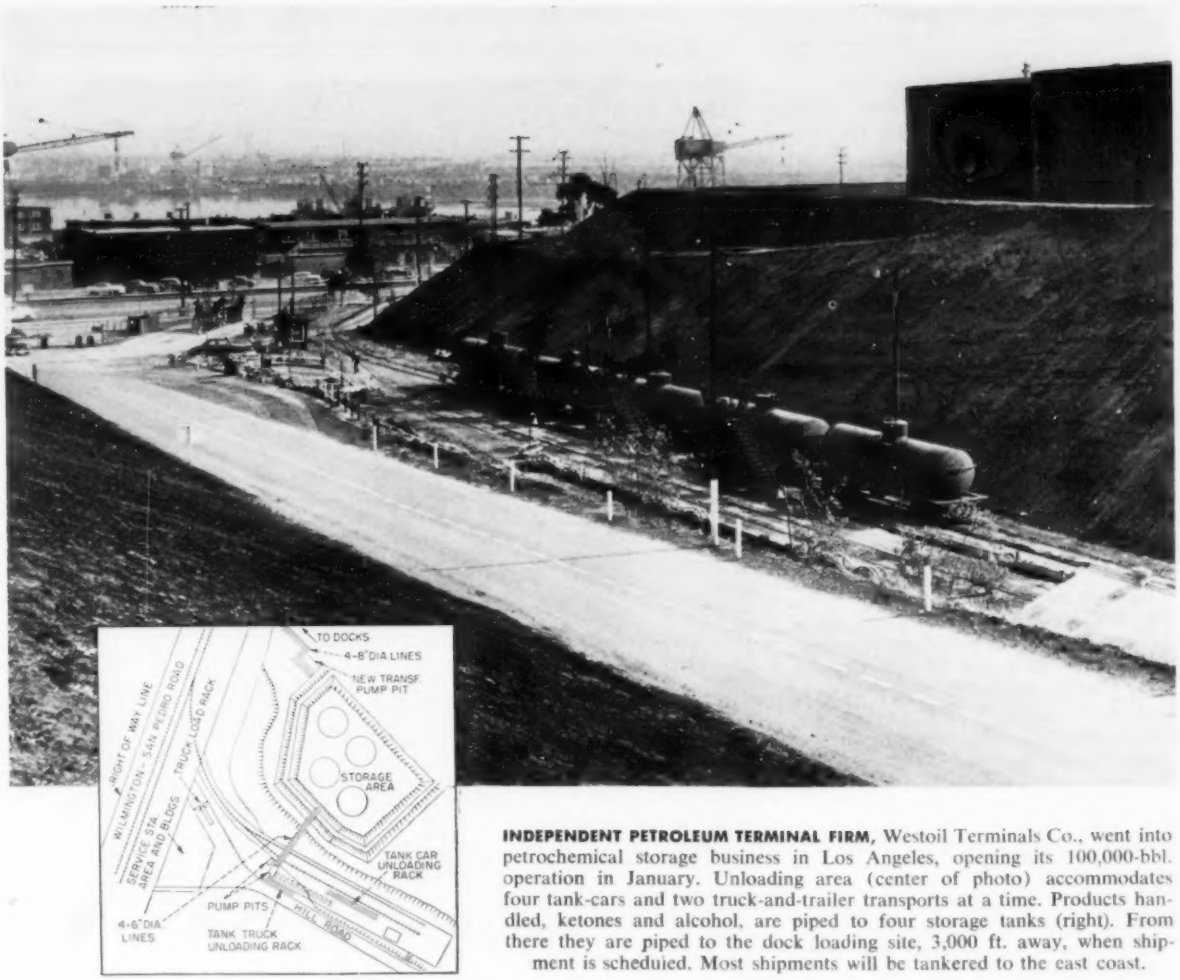
Experts in corrosioneering, Pfaudler can help you avoid mistakes. In designing and fabricating process equipment for nearly 70 years, Pfaudler has accumulated a wealth of experience in handling the widest range of materials. This experience can help you select equipment made of material best suited to *your* purpose.

Perhaps the answer to your need is heat-treated, unstabilized 300 series stainless steel which is corrosion resistant and less costly than the stabilized types. Or maybe you need Pfaudler glassed steel, various types of which are resistant to both acids and alkaline solutions up to pH 12 and 212° F. But whether it is these or alloys of nickel, titanium or other metals, you can depend on Pfaudler for the right answer.

Try us on your requirements —whether they involve a complete process assembly or individual units. Bulletin 902-G-3 explains how you can use Pfaudler services and facilities to best advantage in minimizing corrosion costs as well as getting better yields. Send for it today.

FREE—Buyers' Guide to Pfaudler Equipment and Services . . . a useful reference for process and maintenance engineers. Send for it today.

THE PFAUDLER CO. Pfaudler **ROCHESTER 3, N. Y.**



INDEPENDENT PETROLEUM TERMINAL FIRM, Westoil Terminals Co., went into petrochemical storage business in Los Angeles, opening its 100,000-bbl. operation in January. Unloading area (center of photo) accommodates four tank-cars and two truck-and-trailer transports at a time. Products handled, ketones and alcohol, are piped to four storage tanks (right). From there they are piped to the dock loading site, 3,000 ft. away, when shipment is scheduled. Most shipments will be tankered to the east coast.

Let Someone Else Handle Your Storage Problems

Petroleum terminal operator sets up facilities for Shell petrochemicals on West Coast

By FRANK BREESE
West Coast Editor

THE first small independent terminaling company to get into the petrochemical storage business on the West Coast is Westoil Terminals Co., Los Angeles, Calif. Its facilities were opened in January, when four brand-new, 25,000-bbl. tanks were filled with petrochemicals from Shell Chemical Corp.

This is a new venture for Westoil Terminals, which has specialized in handling conventional petroleum products such as gasoline, fuel oil, Diesel fuel and the like—receiving, storing, shipping, drumming and packaging them. The new products being stored are acetone, iso-propyl alcohol, methyl ethyl ketone and methyl iso-butyl ketone.

The petrochemicals are hauled from Shell's nearby plant at Dominguez, mostly by transport truck, and from the Martinez plant, in the San Francisco Bay area, by tank car. Most of the products are being shipped by tanker to the eastern seaboard, at the rate of about 60,000 bbls. every six weeks.

The petrochemicals stored at the terminal are carried as part of Westoil's regular inventory, along with the other petroleum products at the 1,300,000-bbl. farm. The tanks are gaged each day with the same kind of gage as is used for the oil tanks, and Shell Chemical gets a daily report on its own forms. A monthly recapitulation report

supplements the daily accounting.

Shell Chemical's contract with Westoil for the storage facilities runs for five years, with an option for renewal at a new rate to be negotiated. Terms of the agreement have not been disclosed, but it is presumed that Westoil will be able to pay for its investment within the five years. "It's a very satisfactory agreement," said Jack J. Reed, president of Westoil Terminals, "I wish we had a lot more like it." Mr. Reed has directed the petrochemical storage program and other operations at the Westoil tank farm since he became the company's president in 1950.

The arrangement offers Shell Chemical two solid advantages: First, Shell management doesn't have to spend its time and the company's resources operating storage facilities, but can leave this to Westoil and Mr. Reed, who rates as an expert in these procedures by reason of the company's experience with the storing of petroleum products.

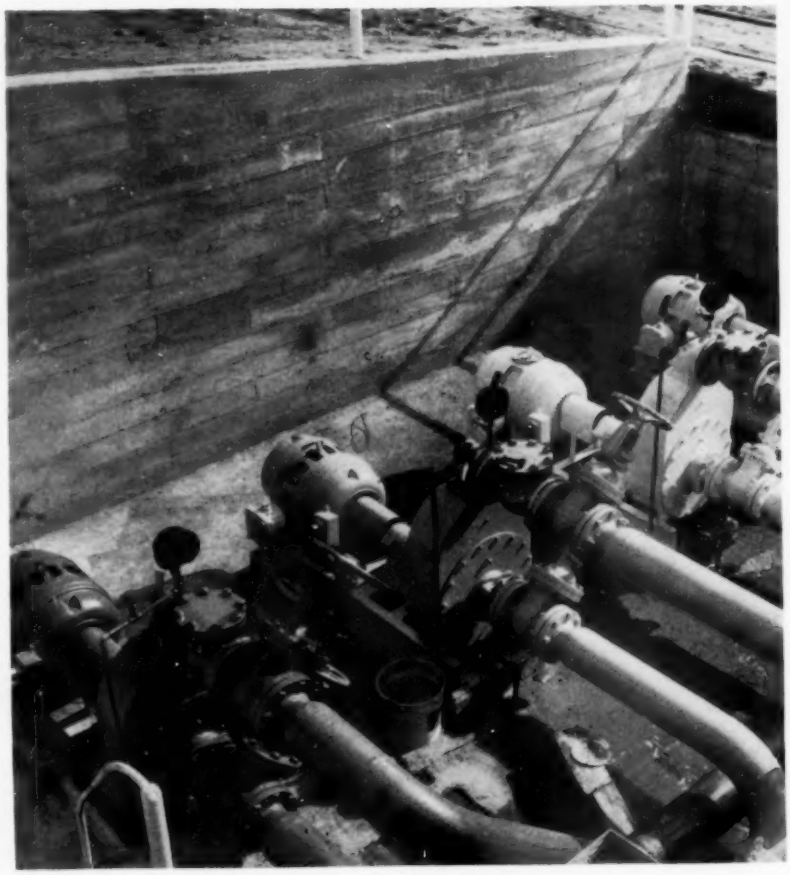
Second, it would be inconvenient for Shell to expand its present storage space in another part of the Los Angeles Basin, while Westoil, on the other hand, has plenty of room for construction even beyond the petrochemical capacity now on its tank farm.

To get into the business of petrochemical storage Westoil had to construct a complete terminal unit, at a cost of about $300,000. Facilities include the four tanks, which total 100,000 bbls. capacity; four new 8-inch pipe lines from the tank farm to the nearby dock; a new transport truck-and-trailer unloading rack with four lines; a new tank-car unloading rack with four lines; a new electrical supply set-up; and a special foam system for fire protection.

When planning the new facilities it was realized that petrochemicals would offer some problems not encountered in the storage of petroleum products. For the materials Westoil was going to handle the chief hazards were seen to be the danger of contamination and the extreme volatility of the chemicals.

To avoid contamination it was necessary to build a contamination-proof storage and pipe line system. An adequate fire-protection system was needed to cope with the danger of combustion, increased greatly because of the volatility factor.

The problem of contamination was solved by the construction of four isolated systems, one for each product. The systems are not interconnected in any way. If a cargo of acetone is unloaded, if flows through its own hose to its pipe line, is pushed by its own pump, goes to its own tank and eventually is transported through its own pipe line to the dock.



UNLOADING PUMPS can handle 500 gal./min. Marlow centrifugal pumps are used and each is painted a distinguishing color because it handles only one product.

To eliminate any chance of confusion the lines and equipment handling each product are painted an identifying color, in addition to the tags and symbols hung on all the pumps, pipes and valves. The petrochemicals themselves are colorless. The color scheme looks like something from a Hollywood Technicolor movie. Lavender was chosen for the methyl ethyl ketone, white for acetone, light green for iso-propyl alcohol, and brilliant orange for methyl iso-butyl ketone.

Before operations began the lines were tested hydrostatically. One minor problem arose when the engineers began draining the water out of the pipes, water being something the ketones and alcohol can't tolerate. A number of low spots were found where the pipes dipped and water had collected in the dips. The pipes were drained at these points, though in one case it was necessary to cut a hole in the pipe to drain off the water, and then weld the pipe closed again.

When construction was completed in January, everything was handwiped to assure cleanliness. Then followed a thorough inspection by Shell Chemical experts, Westoil's own people and industrial laboratory personnel. In testing the tanks, a 10,000-gal. tank-car load of the products was pumped into each tank. The petrochemicals were then tested in a laboratory. All the tanks passed but one, which had picked up some water. That test load was withdrawn and another pumped in.

Now that lines and tanks are set in products there should be no contamination problem unless a line springs a leak, declared Mr. Reed.

Fire protection is a greater problem with these petrochemicals than with the petroleum products Westoil is accustomed to storing. A special foam system had to be installed because ordinary foam won't quench ketone or alcohol fires. Dangerous to handle, these products have a flash point range of 0° F. to 75° F., closed cup. Westoil

JACK J. REED, president of Westoil (left), supervises installation on the liquid foam system. The tank contains 540 gal. of liquid foam.

installed the protection system ordinarily used with these extra-sensitive materials. The fire department requires that at least 540 gal. of liquid foam be kept on hand. The fire pump (a Chrysler Hale 500 gal./min. pump with 50 lbs. pressure) is located in the unloading area, about 400 ft. from the four product tanks, which stand above the area on a knoll. The blending is done at the foam supply tanks and in the ratio of 97% water and 3% foam chemicals.

Each storage tank is equipped with two foam tanks and two chambers, the latter being mounted on the rim of the product tank. Inside each tank is a trough, attached to the side. The foam runs down a 30° slope on the trough, so that a blanket of foam can be laid on the burning liquid at any level inside the tank.

In the unloading rack area are a dozen hand extinguishers stocked with 30 lbs. of dry chemical. At shipside there is standard fire-fighting equipment, which uses fresh and salt water.

Corrosion is not a problem in the petrochemical operation because none of the products being handled is corrosive.

The storage tanks are standard API cone-roof, steel tanks fabricated by Consolidated Western Steel Division of U. S. Steel. At present they are unpainted and will stand rusting for five to six months until the millscale comes off. Then they will be painted white.

In the unloading area there is room for two 7,500-gal. truck-and-trailer rigs at the transport rack and four 10,000-gal. tank-cars at the rail rack. Four drums are kept on hand to catch drips from the tank-cars. These drums are returned to the refinery periodically for recovery of the drippings; the products are worth about 80 cents a gallon, so every drop counts. Losses could take a big bite out of profits.

In the pump pit in the unloading area are four Marlow self-priming centrifugal pumps, with 4-in. suction and 4-in. discharge. Tank cars and transport trucks can be unloaded at the rate of 500 gal./min. Products flow to the tanks through somastic-coated 6-in. lines with a total length of 3,000 ft.

Four big cargo transfer pumps will send the products to the docks. They are Pacific centrifugal pumps, with 8-in. suction and 6-in. discharge, yielding a minimum flow rate of 2,000 bbls. an hour per line. Each pump is equipped with a 125 hp. Fairbanks, Morse motor. Products flow to shipside through four, 3,300-ft., 8-in. lines, also somastic-coated.

Special connecting hoses developed by B. F. Goodrich in conjunction with Shell Chemical at Houston are used in the unloading area and at the dock. The exterior is standard "Neoprene," but the interior is a special compound (laboratory designation 1-47 BT 335), since "Neoprene" swells when in contact with ketones and alcohols. There are 32 18-ft. lengths of 3-in. hose in the unloading area and 8 50-ft. lengths of 8-in. hose on the dock.

Breakdown on expenses was approximately this, said Mr. Reed: $100,000 for the tanks ($25,000 apiece), $35,000 for pump equipment, $50,000 for the electrical installation and the balance for valves, pipes and the fire protection system.

Westoil employs 10 men to work as pumpers and gagers, receiving both the tank-car and the transport truck cargoes. Two men work each shift.

Mr. Reed's boss and the controlling stockholder of Westoil is C. Edward Miller, who also has control of Time Oil Co., another petroleum terminaling, warehousing and marketing operation on the Pacific Coast.

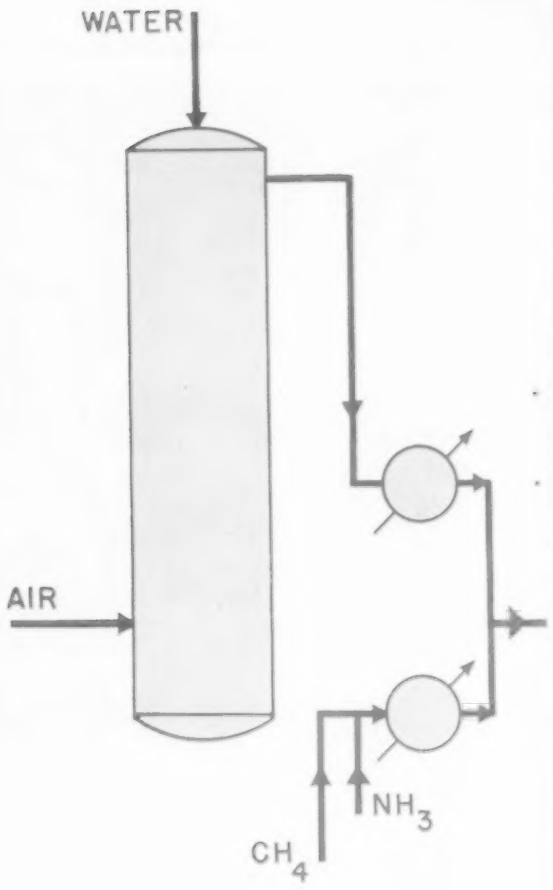
Mr. Miller hired Jack Reed in 1935 as a truck driver for Jobbers Petroleum Sales Co., Seattle, Wash. Mr. Reed was shifted into the office for a time, then, in 1937, was transferred to Portland, Ore., as an accountant for Northwest Oil Co., in which Mr. Miller held half interest. He returned to Seattle in 1941 and became chief accountant for the newly organized Time Oil Co.

Mr. Reed joined the Navy as an ensign in 1942 and was discharged three and one-half years later as a lieut. commander. At the end of 1945 he returned to Time Oil Co., worked in accounting for six months and then moved into the sales department, heading up the lube, grease, heating oil and TBA program. In August, 1950, when Mr. Miller took over Westoil, he assigned Mr. Reed to direct the operation, though Mr. Reed has retained an active part in Time Oil affairs, where he is currently a vice-president and in charge of the firm's tank farm not far from Westoil.

Hydrogen Cyanide

- Manufacturing Methods
- Petrochemical Uses

Part 1—HCN and Acrylonitrile



By PETER W. SHERWOOD
Chemical Engineer
White Plains, N. Y.

HYDROGEN cyanide, produced traditionally by the acidification of cyanamide and cyanide and thiocyanide salts, by the dehydration of formamide, and by recovery from coke-oven gas, made its debut as a primary petrochemical in 1948. During that year, Rohm and Haas Co. began operation of the world's first plant for the production of hydrogen cyanide from natural gas, ammonia, and air at Deer Park, Texas, outside Houston.

The bulk of the output at the Rohm and Haas installation went into the production of acetone cyanhydrin, an intermediate in the synthesis of methyl methacrylate.

Materialization of synthetic fiber developments, which were even then on the horizon, have now made hydrogen cyanide an outstanding petrochemical. But most of the output today is going into the production of acrylonitrile. Two alternate routes to this monomer are in commercial use, both of which require hydrogen cyanide as one of the starting materials.

No less important a consumer of hydrogen cyanide is adiponitrile, an intermediate in the production of Nylon. Three wholly different processes are in commercial use for the production of this compound. The most recent of these, which uses butadiene as starting material, requires the utilization of slightly more than two moles hydrogen cyanide per mole adiponitrile.

A few production figures will illustrate the rapid rise of uses for hydrogen cyanide. As recently as 1948, the entire national output was less than 40 million lbs. and only two large-scale producers (DuPont and American Cyanamid) were active in this field. Sodamide, formamide, and cyanamide were the starting materials. (In addition, Pittsburgh Coke and Chemical Co. recovered slightly less than one million lbs. per year from coke oven gas.)

With the entry of Rohm and Haas, Carbide and Carbon Chemicals Co., and Koppers Co. into the field, the national capacity was boosted to 95 million lbs. by the end of 1951.

During 1952-3, Monsanto Chemical Co. began the production of hydrogen cyanide, and the earlier manufacturers completed considerable plant expansion to raise the combined annual capacity to well above 200 million lbs. hydrogen cyanide. In addition, B. F. Goodrich Co. has recently announced plans for the erection of hydrogen cyanide' and acrylonitrile manufacturing facilities at Calvert City, Ky.

All of this new capacity (with the exception of Koppers' Seaboard, N. J., plant) bases the production of hydrogen cyanide on the partial oxidation of ammonia in the presence of methane in accordance with the overall equation:[1]

$$2CH_4 + 3O_2 + 2NH_3 \rightarrow 2HCN + 6H_2O \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

This reaction is highly exothermic (113.3 kcal/g-mole). Effective conversion rates are obtained in the presence of a suitable catalyst at temperatures above 800° C. In the course of conversion, the temperature of the gas system rises to 1200-1300° C.

A postulated reaction mechanism involves the intermediate formation of nitroxyl:

$$NH_3 + O_2 \rightarrow NH_3{\cdot}O_2 \rightarrow HNO + H_2O \quad \ldots\ldots\ldots\ldots (2)$$

$$HNO + CH_4 \rightarrow HNO{\cdot}H_2CH_2 \rightarrow HN{\cdot}CH_2 + H_2O \quad \ldots\ldots\ldots\ldots (3)$$

$$HNCH_2 \rightarrow HCN + H_2 \quad \ldots\ldots\ldots\ldots (4)$$

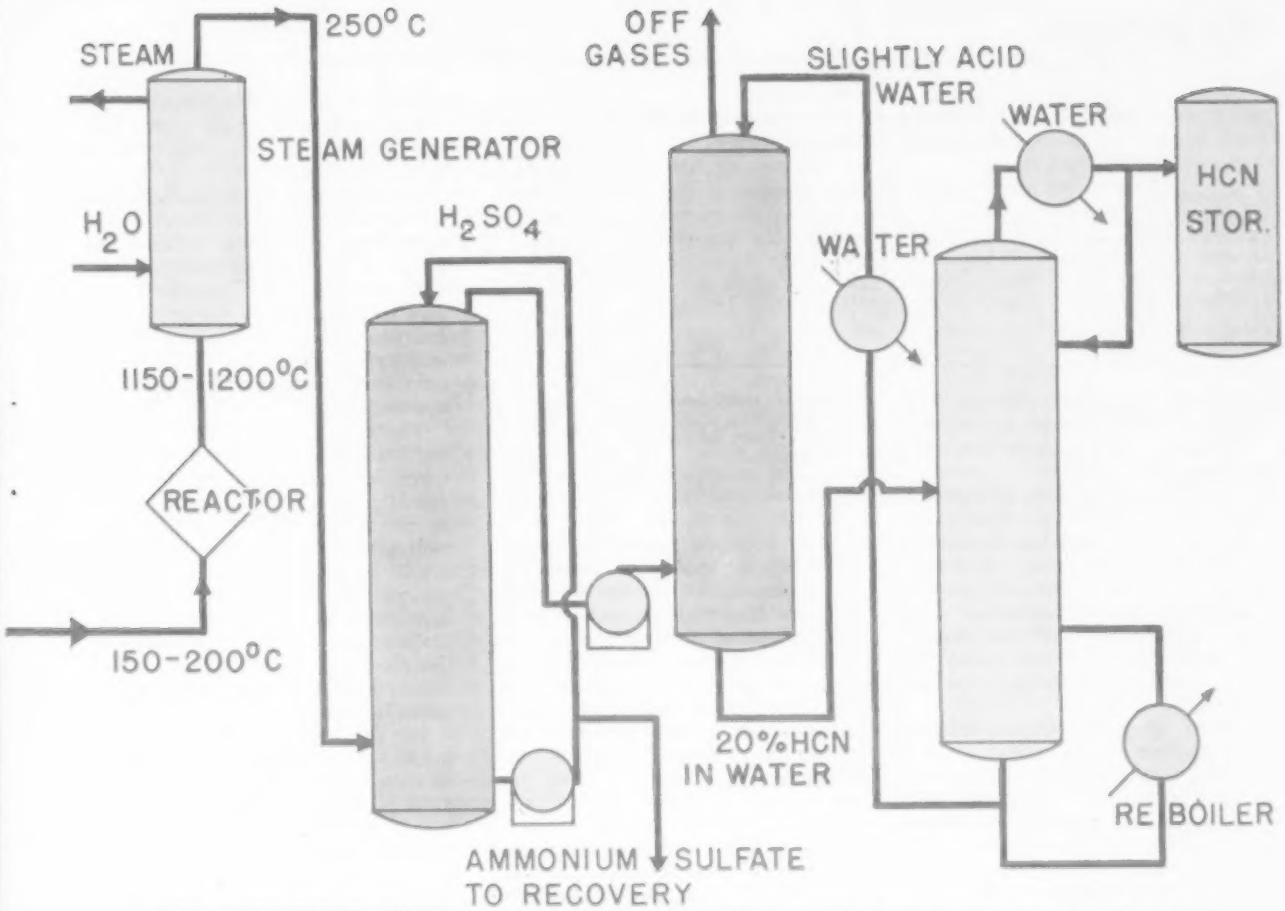


FIG. 1—MONTECATINI PROCESS for the manufacture of hydrogen cyanide from natural gas, ammonia and air

The main by-products of the reaction are nitrogen, water, hydrogen and carbon monoxide (due to the direct oxidation of methane). One very important feature is the occurrence of carbon dioxide in only very small amounts. This is a most significant aspect of the process since the separation of carbon dioxide from hydrogen cyanide presents major difficulties.

It can be shown from equilibrium considerations, that good HCN yields (based on ammonia) are favored by the use of high temperatures and large methane concentrations. However, the desired reaction product is itself subject to accelerated decomposition as the temperature rises. Thus, the useful reaction temperature is limited to a maximum of about 1000° C. The methane ratio is, of course, controlled by economic considerations.

Andrussow,[1] the discoverer of Reaction 1, found that good results could be obtained with a feed gas containing approximately equivalent quantities of methane and ammonia, and somewhat less than the theoretical amount of air. A typical reaction mixture contains 11% ammonia and 12% methane, the remainder being air. Andrussow reports that at 1000° C., 58-63% of the ammonia could be converted to hydrocyanic acid, while 26-30% remained unconverted and 8-12% was oxidized to elemental nitrogen.

Similar results were obtained in recent work by Maffezzoni.[2] The feed mixture contained 11.5% ammonia, 12.5% methane, and 76% air. Operating at space velocities ranging from 40 to 300 liters/hr./sq. cm. catalyst cross section, the following performance was obtained:

Yield per pass (based on ammonia)	61.5%
Ultimate Yield (on ammonia)	84.0%
Yield per pass (on methane)	53.0%

An American version of the process, developed by Freeport Sulfur Co. and the Girdler Co.[3] uses somewhat different catalysts and reactor design to obtain 67% useful per-pass conversion of ammonia. Fifteen percent of the feed ammonia passes through the reactor unconverted, while the remainder is decomposed to hydrogen and elemental nitrogen. I.e., in this case the ultimate yield (based on ammonia) is 74-77%. Raw generator gas has the following composition, expressed in terms of mol-%:

Hydrogen cyanide	5.9
Ammonia	1.6
Carbon dioxide	0.2
Carbon monoxide	4.4
Methane	0.5
Hydrogen	7.5
Oxygen	0.1
Nitrogen	56.7
Water vapor	23.1
	100.0

A large number of metals have been recommended in the patent literature for this reaction. Indeed, Andrussow has indicated that, on theoretical grounds, any catalyst will prove useful which may be employed effectively for the oxidation of ammonia to nitric acid or for its partial combustion to yield elemental nitrogen.

All work to date has, however, indicated that practicable yields can only be obtained with platinum and some of its alloys (with iridium or rhodium). Illustrative is recent work reported by Giovannini,[4] in which a number of other catalysts (Fe-Al, Mn-Al on SiO_2 carrier) were studied over a wide range of operating conditions. Here, the optimum yield obtained under any conditions was only 36.2%. This

Table 1—Acrylonitrile Plants Expected to Be in Operation by End of 1954

Producer	Plant Location	Annual Capacity (millions of lbs.)
American Cyanamid Co.	Warners, N.J.	30
American Cyanamid Co.	Fortier, La.	100
Carbide and Carbon Chemicals Co.	Institute, W. Va.	35
B. F. Goodrich Chemical Co.	Calvert City, Ky.	24
Monsanto Chemical Co.	Texas City, Texas	35
TOTAL		224

should be compared with the 75% ultimate yields referred to above in conjunction with systems employing platinum-base catalysts.

As in the case of nitric acid production, the catalyst is provided in the form of a fine-meshed gauze through which the reaction gases are passed. It is commonly preheated to operating temperature by electrical means. Once this temperature has been attained, the exothermic heat of reaction permits elimination of the external heat source.

While standard platinum-rhodium and platinum-iridium catalyst gauze is initially highly effective, it has only very short active life due to corrosion, embrittlement, and carbon deposition observed in the course of hydrogen cyanide synthesis. In one set of experiments, Chretien and Thomas[5] showed that the platinum loss amounted to six times that observed in the oxidation of ammonia alone.

Maffezzoni[2] found that the amount of rhodium alloyed with platinum was of no significant effect on the active catalyst life. Using pure alloy, it was not found possible to extend the useful life of the catalyst gauze beyond 150 hrs. under any circumstance, and embrittlement, corrosion, and carbon deposition began to take their toll as early as 30-40 hrs. after the beginning of a run.

These difficulties could be traced to the simultaneous presence of HCN and oxygen in the reaction mixture. It was therefore deemed necessary to modify the catalyst sufficiently to obtain commercially feasible on-stream life.

In this work, a catalyst was developed by which HCN could be produced continuously for more than 2000 on-stream hrs. This catalyst is prepared by impregnating a suitable carrier with H_2PtCl_6 solution, and following this by thermal decomposition of the acid to metallic platinum.

With this catalyst, the following performance was obtained in pilot plant runs lasting more than 2000 hrs. and involving catalyst temperatures of 1000° C.:

Per-pass yield, based on initial NH_3	60%
Yield, based on ammonia converted	85%
Per-pass yield, based on feed methane	56.7%

This improved catalyst is incorporated into the Montecatini process for the production of hydrogen cyanide, which is illustrated in Fig. 1.

Combustion air is washed for the removal of soot and scale-forming materials which might obstruct the catalyst. It is then passed through a heat exchanger and joins a mixture of ammonia and methane which has been independently preheated. The mix temperature is between 150 and 200° C.

The gaseous mixture contains between 11.5 and 12.5% ammonia. Methane:ammonia ratio is controlled between 1.06 and 1.09. This is the feed to the catalyst chamber.

In the course of the partial combustion reaction, the temperature of the system rises to nearly 1200° C. Rapid cooling is required to minimize yield-consuming decomposition reactions. Immediately upon issuing from the converter, the reactor gases are therefore fed to a waste-heat boiler in which their sensible heat is utilized for the production of 6-7 lbs. of steam per lb. of hydrogen cyanide.

As we have seen, a portion of the ammonia feed remains unconverted. In the Montecatini process, some 31 lbs. of ammonia are associated with every 100 lbs. of hydrogen cyanide in the reactor gases. There is, of course, a substantial and wide-spread market for fertilizer-grade ammonium sulfate, and residual ammonia may therefore generally be recovered by absorption in sulfuric acid. This practice is followed in the Montecatini process as well as in most, if not all, American synthetic hydrogen cyanide installations.

The scrubbing medium is a recirculated solution of ammonium sulfate and sulfuric acid. A side stream of the strong liquor is withdrawn and evaporated for the precipitation of ammonium sulfate crystals, which are recovered by centrifugation. Most of the filtrate may be recycled to the ammonia scrubbers after fortification with sulfuric acid.

Hydrogen cyanide is removed from the scrubbed gases by absorption in slightly acidulated water, which is fed as recycle from the HCN-stripper column bottoms. The absorber liquor may be acidulated by the addition of phosphoric acid at the top of the stripper column where it serves as stabilizer for concentrated hydrogen cyanide.

The off-gases leaving the top of the HCN absorber are vented. The bottoms, which contain 20% hydrogen cyanide, are fed to a stripper column in which the binary system water-hydrogen cyanide is separated by fractional distillation. In good operating practice, the bottoms may be readily depleted to 0.02% hydrogen cyanide. Maintenance of a low HCN-content at this point is of importance since a side stream portion of the bottoms is rejected to sewage.

The condensed overhead, containing 98.5+% hydrogen cyanide should be cooled to a storage temperature of 5° C. or less. A suitable stabilizer (e.g. phosphoric acid) must be added wherever concentrated liquid hydrogen cyanide is encountered. In at least one American installation, a stabilizer concentration of not less than 0.1% is maintained at the top of the stripper column, and its concentration in the storage tanks is kept at not less than 0.2%. This precaution is of great importance because of the pronounced tendency of hydrogen cyanide to polymerize spontaneously and at explosive rates if it is not properly stabilized and, especially, if conditions are slightly alkaline.

The production of one pound of hydrogen cyanide by a process of the type described, in which unconsumed ammonia is recovered as ammonium sulfate, calls for the use of 1.05 to 1.08 lbs. of methane and approximately 1.05 lbs. of ammonia. Since effective ammonia recovery is about 0.31 lbs., its net consumption is 0.74 lbs. per pound of HCN.

By converting residual ammonia in this manner, it is, of course, lost to the process. This is a point of objection, as is the cost of ammonium sulfate recovery, which is not inconsiderable. The physical properties of ammonia and hydrogen cyanide make a direct separation quite difficult. Both compounds are soluble in the same common solvents. Use of an acid scrubbing medium results in ammonium salt formation while stable cyanides are formed in alkaline solution. Under

neutral conditions, ammonium cyanide is formed but will decompose almost immediately, leaving a tarry residue.

To overcome these difficulties, Freeport Sulphur Co. has developed an ingenious absorption method for the separate recovery of hydrogen cyanide and ammonia as such.[5, 6]

In this process an aqueous solution of 8.3 wt. % pentaerythritol and 2.5% boric acid serves as scrubbing medium for the reactor gases. Both ammonia and HCN are dissolved in this liquor. However, while HCN is simply dissolved as such, ammonia forms a salt with the polyhydroxy-boric acid complex. This salt is stable at low and medium temperatures and a hydrogen cyanide-water mixture may be stripped from the primary solution by the application of vacuum at an operating temperature of 80-90° C.

The hydrogen cyanide-free solution is finally stripped of ammonia in a secondary desorber operated at 2-3 atms. and 130° C. At this temperature the ammonium salt is almost completely dissociated and released ammonia is taken overhead. The stripped solution is reconcentrated. Overhead ammonia is freed of water by conventional means and is then ready for recycle to the HCN-generator.

Production of Acrylonitrile

As raw material for some types of synthetic rubber, for a number of synthetic fibers, and for a variety of plastics and soil conditioners, acrylonitrile promises to consume the lion's share of America's output of hydrogen cyanide during the coming years.

Few chemicals can claim the spectacularly rapid expansion prospects which appear in store for acrylonitrile at this time. Whereas about 40 million lbs. were consumed in the U.S. during 1952, the sales outlook for 1956 has been estimated at the 160 million-lb. level. Several plants, which are now coming in, will have enough production for adequate supply.

By the end of 1954 acrylonitrile will be produced at the plants listed in Table 1.

The end use pattern of acrylonitrile has been charted in a recent study,[7] which demonstrates a significant shift in emphasis from nitrile rubbers to artificial fibers.

Use	Consumption (millions of lbs.) 1952	1956
Nitrile Rubber	20	25
Synthetic Fibers	10	100
Plastics	5	25
Miscellaneous	5	10
Total	40	160

Nitrile rubbers (Buna-N, GR-A) which are essentially copolymers of butadiene and acrylonitrile, were the original foundation for the acrylonitrile industry. While cheaper GR-S rubber (butadiene-styrene) and, to a lesser extent, neoprene, soon eclipsed nitrile copolymers from the role of all-purpose rubber for which they had been slated during the early days of World War II, specialty applications did boost consumption of nitrile rubbers to nearly 15,000 long tons in 1944. After this peak year, consumption fell off to almost one-third this amount in 1947. Good recovery has, however, been made in the interim, and nitrile rubber today finds important application where its oil-resistant characteristics can be used to advantage. Thus, the biggest single outlet is in mechanical rubber goods (engine mountings, gaskets, etc.).

Water-dispersed latices of nitrile rubber, a newer development, have added significantly to the list of outlets, notably for use as finishing agents for leather, and saturants and impregnants for paper and textiles.[8]

Blends of nitrile rubber with phenolic resins have been found to result in materials of outstanding shock and abrasion resistance and great toughness. Blends with polyvinyl resins find increasing use as non-migrating plasticizers.

While these developments in the nitrile rubber field are not without significance in the growth of acrylonitrile consumption, commercialization of acrylonitrile-based synthetic fibers promises to dwarf all other uses for this monomer. First commercial production of this type of fiber was realized in 1950 (DuPont's "Orlon"). Other acrylonitrile-based fibers have since made their commercial appearance or are slated to go into production in the very near future. These include Carbide and Carbon's "Dynel," Chemstrand's "Acrilan," and American Cyanamid's "X-51."

Textiles made from these fibers were initially received by the public with much enthusiasm. Due to high prices, as well as a number of performance drawbacks, the market has stiffened somewhat in recent months. Technical objections are, however, being rapidly overcome, and high prices, which are, of course, to a large extent related to the cost of monomer, are subject to amelioration by process improvement.

In the plastics industry, the third-ranking outlet for monomeric acrylonitrile, this compound serves as copolymerizing agent — usually with styrene (e.g. Bakelite C-11) and vinylidene chloride (Dow's "Saran F-120").

Polyacrylate soil stabilizers (which are based on acrylonitrile) were introduced about two years ago. The tremendous market potential of this type of product caused a flurry of excitement at the time. However, competitive soil stabilizers have since made their commercial appearance and appear, at least at this writing, to have gained a certain predominance.

With two highly reactive groups, acrylonitrile may serve as raw material for a large number of chemical derivatives. Among the commercially important ones might be mentioned polyacrylic acid, which finds application in the processing of nylon filament. Acrylamide and some of its derivatives show promise in the plastics field, as does succinonitrile ($(-CH_2CN)_2$. Propionitrile (CH_3CH_2CN), produced by the hydrogenation of acrylonitrile's double bond, is a useful and versatile solvent.

Until the tremendous market expansion of the last few years, the nation's entire supply of acrylonitrile was produced by a two-step synthesis starting with ethylene oxide and hydrogen cyanide, this being the process employed at American Cyanamid's Warner plant.

However, at most, if not all, of the large new plants which have been erected since 1952, an alternate route is being followed. In these installations, acrylonitrile is produced by the direct synthesis from acetylene and hydrogen cyanide. The choice of this process is dictated by its more favorable economics in very large production units.

Ethylene Oxide Route—This process involves the conversion of ethylene oxide to ethylene cyanhydrin, which is then dehydrated to yield acrylonitrile.

$$(CH_2)_2O + HCN \rightarrow CH_2OH{\cdot}CH_2{\cdot}CN \rightarrow CH_2{:}CH{\cdot}CN + H_2O \quad (5)$$

The reaction between ethylene oxide and hydrocyanic acid is carried out in the presence of water and an alkaline catalyst. In one commercial operation, the preferred composition by volume of the reaction medium is 200 parts water, 8 parts diethylamine, and 5 parts 50% aqueous NaOH.

The reactor is a vertical cylindrical cast-iron vessel provided with agitator and cooling coil for the removal of the exothermic reaction heat. Ethylene oxide is introduced at a point near the bottom of the kettle, while liquid hydrocyanic acid is fed to the system at a point above the liquid surface. Vent gases are cooled to —10° C. in an

overhead heat exchanger in order to minimize raw materials losses.

The reaction is started at 55° C. The raw materials are introduced in equimolar quantities at a rate compatible with the cooling facilities. Addition of raw materials is stopped when about 6 to 7 volumes of ethylene oxide have been introduced per volume of water initially present (this may take up to 10 hours).

At this point, the system temperature is raised to 60° C., where it is held for several more hours to permit more complete utilization of the raw materials. The alkaline mixture is finally neutralized and purified by distillation at 100-150 mm. Hg abs. and 100-110° C. still temperature. The overhead consists in the main of unconverted HCN, ethylene oxide, and water. Ethylene cyanhydrin is withdrawn as bottoms at 88-90% purity. Contaminants are residual water, polymerized hydrogen cyanide, and salts which were formed during the neutralization step. This crude product may serve as feed to the dehydration step without further purification. Overall yield is 88-89% of theory.

In a modification of this process, a portion of the crude ethylene cyanhydrin is used to absorb ethylene oxide and hydrogen cyanide as they are evolved during the topping operation. This stream of cyanhydrin, together with absorbed raw materials, is recycled to the reactor. This version has certain operating advantages and reduces refrigeration requirements. It does not, however, appear to have a favorable effect on overall yield.

The dehydration of ethylene cyanhydrin is carried out commercially in the *liquid phase*. The patent literature contains several references to *vapor-phase* dehydration in the presence of catalysts (activated charcoal, alumina, etc.). However, this method appears to offer unsatisfactory yields and obstructions form readily to destroy catalyst activity.

Numerous catalysts can promote the dehydration reaction effectively, among them: tin, sodium bisulfate, ammonium phosphate, magnesium oxide, magnesium carbonate, etc. It is the last named which has found commercial application in German technology. According to the trend of the patent literature, American practice has been developed along the same general lines.

Liquid-phase dehydration lends itself to semi-continuous operation. Crude ethylene cyanhydrin is charged to an agitated cast-iron kettle together with magnesium carbonate (in the approximate ratio 12:1).

The charge is heated to 200° C., the dehydration temperature. Acrylonitrile and water are taken overhead, and an equivalent amount of make-up ethylene cyanhydrin is continuously charged to the reaction vessel until the consistency of the bottoms impedes further operability.

In addition to the two reaction products, the overhead vapors contain some unconverted ethylene cyanhydrin. This is condensed in a dephlegmator and refluxed to the reactor. Acrylonitrile and water are then recovered in a final condenser.

Two phases are formed, and the organic layer, after separation, is distilled for the recovery of polymerization-grade acrylonitrile. To inhibit yield-wasting polymerization, a stabilizer (p-phenylene amine and methylene blue) is added to the still charge.

The lightest boiler is the acrylonitrile-water azeotrope which is, of course, recycled to the original still charge. Commercial acrylonitrile passes overhead as intermediate boiler.

The heavy components are subjected to a final heating for the complete removal and recovery of residual acrylonitrile, and are finally discarded.

Direct Synthesis—This is the process which is the basis for almost all of the new acrylonitrile plant capacity in the U.S.:

$$C_2H_2 + HCN \rightarrow CH_2{:}CH{\cdot}CN \quad (6)$$

The reaction is carried out in the presence of a liquid catalyst. Typical composition is an aqueous solution of ammonium chloride and cuprous chloride in equimolar quantities. Salt concentration is controlled to a specific gravity of 1.66-1.69.

Control of the pH of the catalyst is of great importance. Small amounts of by-product monvinyl chloride are continuously formed and the resultant hydrogen chloride depletion must be made up periodically.

The catalyst solution is charged to the converter, a cylindrical rubber-and-acid brick-lined vessel, in which the reaction is carried out continuously. Acetylene is introduced into the catalyst solution through a number of orifices located near the bottom of the converter. Liquid hydrogen cyanide is fed at a somewhat higher point in the reactor.

The optimum ratio of reactants entering the converter is approximately 10 moles acetylene to 1 mole hydrogen cyanide. Operating temperature is in the range of 80-90° C. The higher temperature is made feasible by working at elevated pressures (up to 15 psig.).

Conversion of hydrogen cyanide is substantially complete. Acrylonitrile yield is of the order of 80-85% (based on acetylene) and 90-95% (based on hydrocyanic acid).

If the reactants are sufficiently purified, catalyst life of 4 to 6 wks. can be attained. Actually, catalyst activity is continuously kept up by withdrawing a small stream from time to time and making it up with an equal quantity of fresh solution.

The effluent gases from the converter are cooled to 25° C. and are washed with a sufficient quantity of water to assure substantially complete removal of acrylonitrile. The scrubbed gases are refortified with acetylene and, with the exception of a small bleedstream, are recycled to the reactor.

The wash liquor, which contains about 2% acrylonitrile, is rectified by azeotropic distillation. The overhead is condensed and allowed to stratify. The lower, aqueous layer is returned to the column. The organic layer is crude acrylonitrile of the following approximate composition:[39]

Compound	Wt.-%	B. Pt. °C
Acetylene	0.5	—
Monvinyl acetylene	3	5
Acetaldehyde	4	21
Hydrogen cyanide	1-2	27
Chloroprene	1	59
Water-acrylonitrile azeotrope	3.5	71
Acrylonitrile	80	77.6
Dinvinyl acetylene	0.2	83-84
1-cyanbutadiene	4	135
Lactonitrile	2	182

Final purification is carried out in a series of distillation steps. A typical refining system begins with a primary column in which the cut is taken between acrylonitrile and lower boilers. The water-acrylonitrile azeotrope is withdrawn at an intermediate point of the column, condensed, and permitted to separate into two layers. The organic acrylonitrile-rich phase is refluxed to the column.

The bottoms of the primary column are fed to the acrylonitrile still in which the desired monomer is taken overhead in substantially pure form. A third still serves to recover residual acrylonitrile from the bottoms of the secondary column.

Traces of divinyl acetylene are unavoidably present in the semi-refined acrylonitrile from the secondary still. This impurity interferes with a number of polymerization reactions, and must therefore be removed. A preferred method of purification is batch steam distillation of a water-acrylonitrile mixture. The first small overhead fraction contains the bulk of divinyl acetylene. The method is, however, quite

costly and other purification schemes are in development.

Commercial acrylonitrile produced by the direct synthesis is of very high purity (99.9%+) and therefore will polymerize more readily than the product of ethylene cyanhydrin dehydration (which is naturally inhibited by the presence of small quantities of amino compounds). A tendency to polymerize spontaneously in storage can be overcome by the addition of suitable stabilizers.

A second article in this 2-part series on the production and petrochemical uses of hydrogen cyanide will appear in the April issue of PETROLEUM PROCESSING and will discuss the manufacture of acrylates, methacrylates and adiponitrile.

References

(1) Andrussow, Z., *angew. Chem.*, 48, 595 ff. (1933).
(2) Maffezzoni, *Chimie et Industrie*, 69, 842 ff. (1953).
(3) Updegraff, N., *Petroleum Refiner*, 32, No. 2, 197 ff. (1953).
(4) Giovannini, E., *La Chimica e l'Ind.*, XXXIII, 480 ff. (1951).
(5) Chretien & Thomas., "Bull. Soc. Chim. France," 1948, pp. 354 ff.
(6) U. S. Pat. 2,590,146.
(7) *Chemical Week*, February 14, 1953, pp. 59 ff.
(8) Weith, A. J., paper presented to Chemical Market Research Assn., June 4, 1953.
(9) Ullmann, "Enzyklopädie der chemischen Technik," 3rd Ed., Vol. 3 (1953) p. 85.

Do You Know These Words?

By B. H. WEIL
Manager, Information Services
Ethyl Corp., Res. & Engrg. Dept.
Detroit, Mich.

A regular department intended to help administrators and operating men alike keep abreast of technical names and processes in the petrochemical field.

Vinyltoluene

Vinyltoluene, pronounced "**vie**-nihl-**tohl**-yu-een," is a petrochemical which this year is assuming commercial status for the first time, as a competitor with and replacement for styrene in plastics and surface coatings. Also known chemically and commercially as "methylstyrene," this petrochemical is a colorless liquid which is lighter than water in unit weight and which freezes well below and boils well above the figures for the latter substance.

It has the formula $CH_2{=}CH\text{-}C_6H_4\text{-}CH_3$, and commercially is actually a mixture in varying proportions of two or more of three isomers (chemicals composed of the same elements in the same proportions by weight but differing in properties because of differences in structure).

Vinyltoluene, like styrene, is a highly reactive monomer (a chemical unit which may react with a similar unit or other monomers to produce long chains or cross-linked chains of molecules, as in synthetic resins or fibers).

During the recent shortage of benzene, it was touted as a possible substitute for benzene-derived styrene for the manufacture of synthetic rubber and plastics, and is highly regarded by some as a permanent means of freeing polymer producers from the ills of recurring benzene shortages.

On its own, however, it has a promising future in the field of surface coatings—for the manufacture of styrenated oils and alkyd resins for use in paints and varnishes. Moreover, at least one semi-commercial mixture of vinyltoluene isomers yields a polymer (synthetic resin) which has a higher heat distortion than polystyrene.

According to the literature, the commercial plant scheduled for completion in 1954 will produce vinyltoluene by reaction (alkylation) of toluene with ethylene, followed by dehydrogenation of the ethyl side chain. The semi-commercial process of another company also starts with toluene but causes this to react with acetylene to produce an intermediate, which is cracked over clay catalysts to yield vinyltoluene. Toluene, ethylene, and acetylene are all petrochemicals, the first being obtained from the catalytic reforming of naphthas and the last two by cracking of selected hydrocarbon fractions under certain conditions.

Vinyltoluene faces an interesting future, one which will depend upon the economic interrelationship of toluene and benzene and on its own specific merits. It is another in the growing list of petrochemical raw materials for the plastics industry.

Acetylene

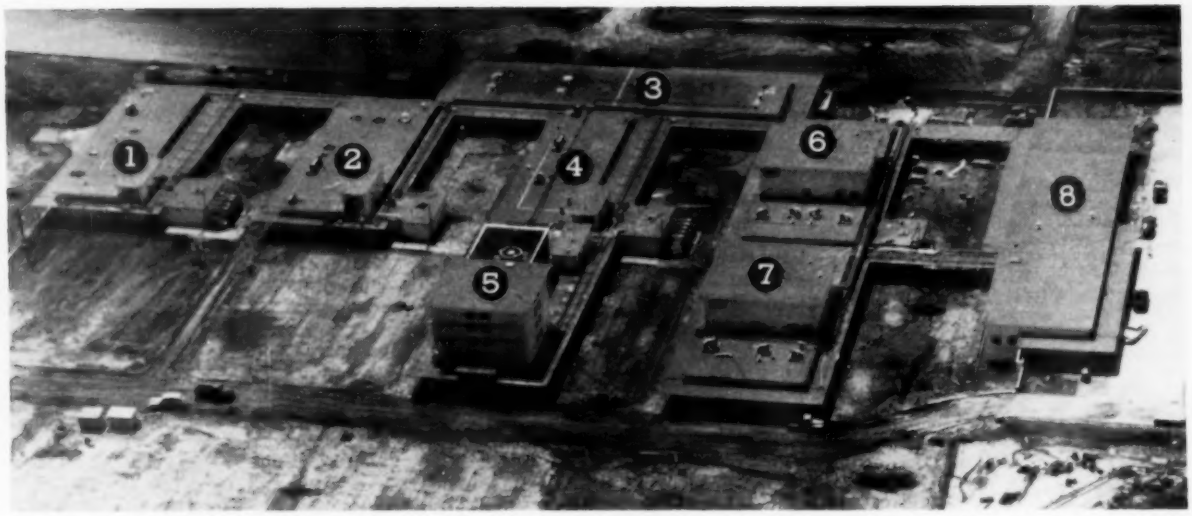
Acetylene, pronounced "aah-**set**-ih-lean," is still produced predominantly from coal-based calcium carbide; but large quantities are now being made from natural gas, and it may not be long before this becomes the primary source. It is a colorless gas with an ethereal odor which is usually made unpleasant by impurities. Highly flammable, it burns with a brilliant white light and is explosive if compressed or mixed with air in certain proportions. It is slightly lighter than air.

In the past, acetylene has been produced largely by reaction of water with calcium carbide, which in turn is produced from lime and coke. Historic uses for acetylene include welding, illumination, and the synthesis of organic chemicals. In this country today only the first and third of these uses are important, with organic synthesis taking about 70% of acetylene output.

Chemical uses are legion and encompass such consumer products as plastics, fibers, insecticides, vitamins, dyes, and explosives. By 1955, forecasters predict that the end-use pattern in this country for some 750,000,000 pounds of acetylene output will be: Vinyl chloride, 30%; Neoprene synthetic rubber, 28%; trichloroethylene (solvents), 20%; acrylonitrile (fibers, soil conditioners), 10%; vinyl acetate, 8%; and miscellaneous, 4%. Demand in 1960 may be double this.

Sometime this year, the capacity in this country for producing acetylene from natural gas will approximate 200,000,000 lbs. per year, a total which is expected to grow rapidly in the next few decades to a forecasted 75% of output by 1975. This is predicted because there is little room for improvement either in the coal-based calcium carbide process or in the economics of its raw materials, whereas the economics of using natural gases are very attractive, and processes for large-scale production of acetylene from these (by cracking under controlled conditions) are already commercially practical and continue to be improved.

Acetylene is a chemical which has long found extensive use, and one whose derivatives must compete with similar or identical ones from such materials as (petrochemical) ethylene. But the impetus given research in this country by German wartime developments, combined with the burgeoning demands for known derivatives and the growing economy of using natural gas as a raw material, make it possible, as *Chemical Week* observed, to call acetylene "just a billion-pound baby."



PETROCHEMICAL RESEARCH is carried out in Building No. 7, one of eight separate buildings comprising the new research center at Freeport, Texas. See text for reference to other numbers

New Research Center for Dow

Chemical firm's new facilities in Southwest include accent on petrochemical studies

PETROCHEMICAL research plays a prominent role in activities at one of the newest research centers in the Southwest, that of Dow Chemical Co. at its Texas Division in Freeport. Dedicated to and named for Dr. William Reed Veazey, recently retired Dow director and research consultant, the $2,600,000 facility has been "onstream" since last October.

With 69,000 square feet of space, it houses the Texas Division's organic, chemical engineering, petrochemical, and electrochemical research as well as a general analytical laboratory.

The new center comprises eight reinforced concrete buildings as shown in the general view above. These buildings house, as indicated by the numbers on the photograph: (1) electrochemical engineering department, (2) central laboratories—analytical work and glass blowing, (3) store room and shops, (4) chemical engineering department, (5) pilot plant, (6) plastics and resin research, (7) petrochemical research, and (8) offices, library, and patent group.

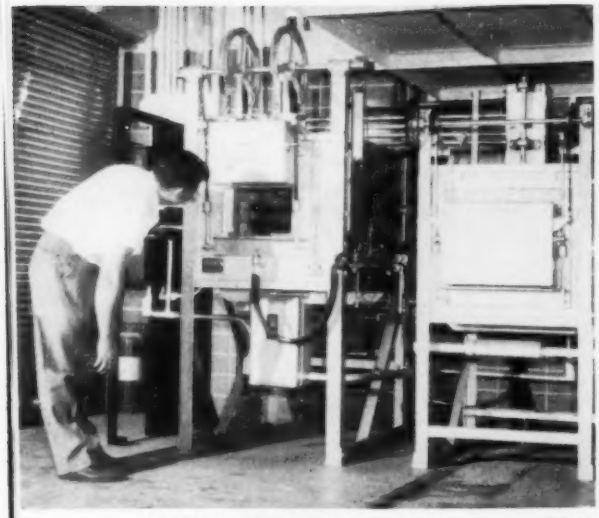
Both the organic and the technical research groups of the Texas Division of Dow will use the new W. R. Veazey Research Center. The organic group investigates petrochemical processes and products, plastics, and synthetic resins. The technical research group gives its attention principally to new products and processes, construction materials, instrument development, electrochemistry, corrosion control, and agricultural chemicals, but also does the analytical work and the glass blowing.

Construction throughout the center was of reinforced concrete, with exterior walls of double thickness (concrete blocks outside and glazed structural tile or plastered concrete blocks inside). Interior partitions vary, using such materials as concrete block, glazed structural tile, tectum board, red birch plywood, plaster, and "Styron" plastic tile. Ceilings in the laboratory buildings are exposed concrete while those in the offices are acoustical tile.

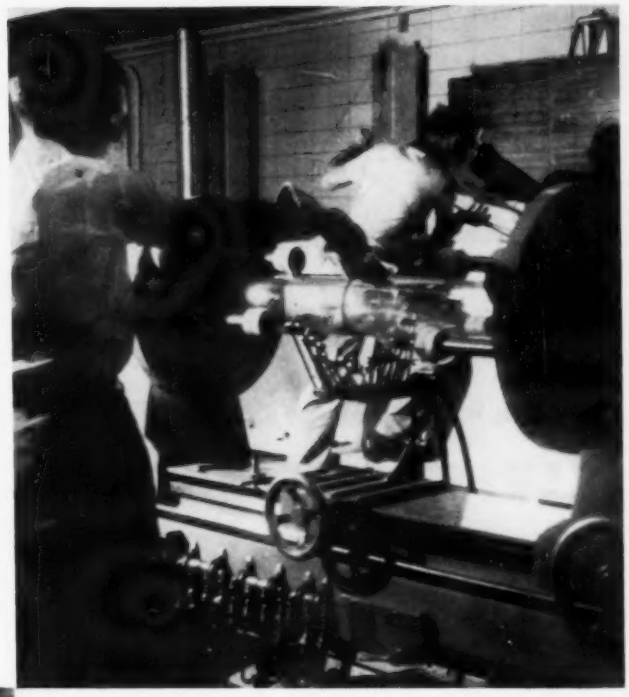
All exterior doors have "panic-type" hardware for quick exit. The lower half of all windows raises and the outside venetian blinds are hinged at the top to provide emergency exits. All rooms above ground level are equipped with exterior fire-escapes. Sprinkler systems have been installed in all buildings except that housing the offices and library.

Dr. Veazey, who retired in June, 1953, after 37 years of association with Dow, has been a member of the board of directors for 26 years. He joined the company in 1915 when he undertook special research work in magnesium.

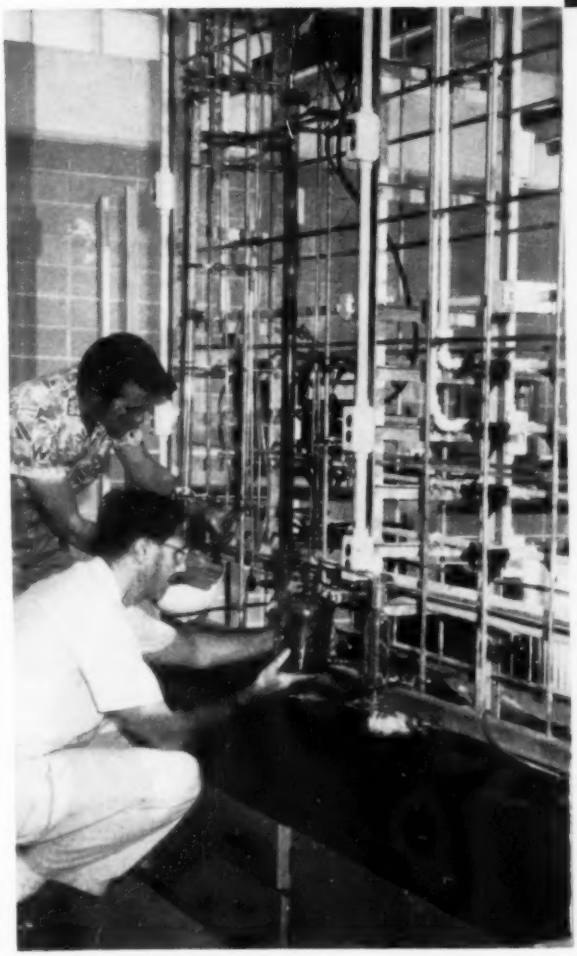
LITERATURE INVESTIGATIONS, an essential adjunct to laboratory research, are provided by a complete technical library



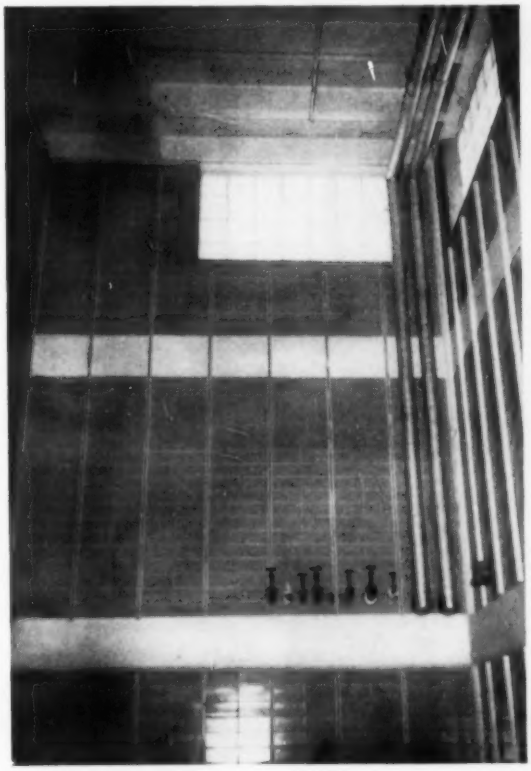
CORROSION PROBLEMS are studied in these high-temperature furnaces in electrochemical department



GLASS BLOWING SPECIAL SHAPES is a requisite in any research center. This equipment is in the central laboratories building



BENCH SCALE PROCESS STUDIES are performed on units with wide flexibility in the chemical engineering department



MINIATURE UNITS, up to three stories in height are employed by Dow in its organic and petrochemical work

24 ACRES *Cover the World*

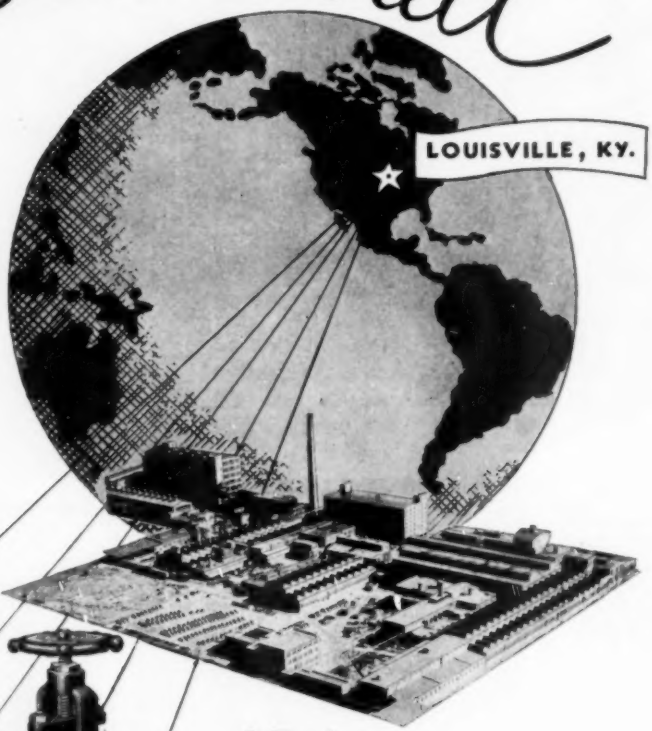
. . . with TOP QUALITY

DROP FORGED STEEL

VALVES, FITTINGS and FLANGES

by

Vogt



Air View of
Henry Vogt Machine Co.

This 24 acre Vogt plant supplies the most comprehensive line of top quality *drop forged* steel piping materials anywhere available to industry. That's why they're the choice of leading refineries, power plants, chemical plants, etc., the world around!

OUR COMPLETE LINE INCLUDES

Flanged, Screwed and Socket Weld End Globe, Gate and Check Valves • Ells, Tees and Crosses • Couplings • Bushings • Plugs • Unions • Flanges and Flange Unions • Welding Heads

HENRY VOGT MACHINE CO. LOUISVILLE 10, KY.

Branch Offices: New York, Philadelphia, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va.

CHEMICAL PROCESS NEWS

PUBLISHED BY CHEMICAL PROCESS DIVISION, THE M. W. KELLOGG COMPANY MAR. 1954

NOTES ON

PHTHALIC ANHYDRIDE

Of interest to chemical processors in general, and particularly in the United States where the irregularity of supply of naphthalene has hampered the production of phthalic anhydride, is the development of a new feed-preparation step in Kellogg's laboratories which permits the use of low-grade, sulfur-containing naphthalene in the Fluid phthalic anhydride process.

* * *

This step in effect increases the supply of feed available for the Fluid process with its recognized advantages over conventional methods: higher yields . . . lower initial cost . . . easier handling of catalyst . . . longer catalyst life . . . increased safety through better control of heat.

* * *

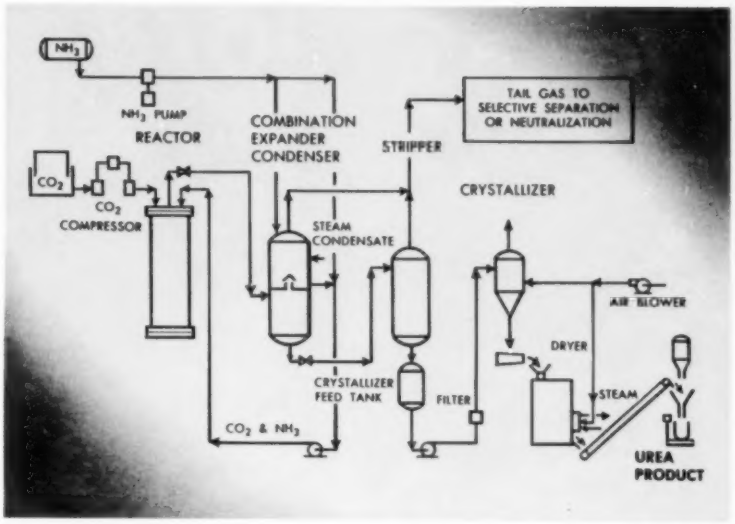
Meanwhile several design improvements are incorporated in new Fluid phthalic plants designed and now being erected by Kellogg. When these units are completed they will produce about 50 million pounds of phthalic annually.

* * *

While the basic chemistry involved in the oxidation of naphthalene in the presence of a catalyst is well known to chemical manufacturers, new developments in the process for this chemical have not been extensively publicized.

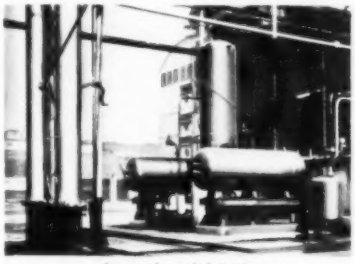
* * *

One of these is an improved condensing system which may be included under certain circumstances. This not only reduces capital investment but also improves actual operating conditions. It precludes, for example, the need for operators to come in direct contact with the phthalic or its fumes.



Montecatini Process Produces Higher Quality Urea at Lower Investment

The new low-cost method of producing synthetic urea of exceptional purity developed by Montecatini—well-known Italian firm—



Ammonia weigh tanks

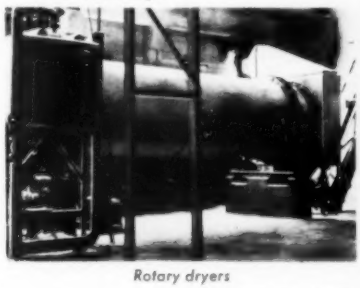
is shown in the flowsheet above, while accompanying photos show some of the actual equipment. Kellogg is the exclusive licensor of the process, a method which reflects more than 30 years of experience in nitrogen chemistry.

One of the most important features of the Montecatini process is virtual elimination of corrosion problems generally associated with urea synthesis. This is accomplished not only through careful selection of materials but also through maintaining a high concentration of ammonia which tends to curb corrosion. Furthermore, relatively mild conditions are employed in the reaction zone in comparison with other urea processes, thus further limiting corrosion.

As a result of these factors, considerable costly alloy equipment is eliminated from many parts of the plant and maintenance expense is held at a minimum.

In addition to these factors affecting the costs of plant and operation it is also of interest that the process produces resin-grade urea without the additional expense of special purification steps. An aqueous solution of 5% urea from a Montecatini plant is clear and colorless, a difficult specification to meet and one which is particularly important for plastics manufacture. A low biuret content of less than 0.01 wt.% is also obtained.

From the standpoint of using the urea as a feed supplement, it is also of importance that no lead-lined equipment is employed in the process, eliminating the possibility of lead toxicity.



Rotary dryers

(SEE REVERSE SIDE)

CHEMICAL PROCESS NEWS

CONTINUED FROM PRECEDING PAGE

Unique Ammonia Plant Completed On West Coast

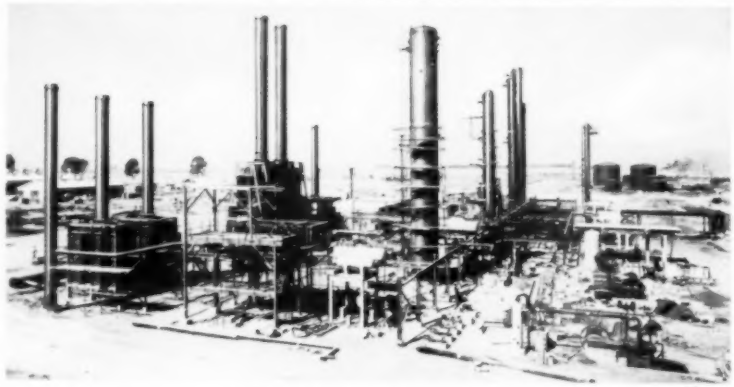
A unique anhydrous ammonia plant, employing a special high-pressure gas reforming step, is now on stream on the West Coast. It will produce well over 300,000 pounds of product daily from a natural gas feed stock.

The unusual reforming step is the result of studies conducted in a Kellogg semi-commercial plant which showed that important economic savings could be made in the process. All that was required was to take full advantage of the relatively high pressure at which natural gas is available.

Based on this research, Kellogg engineered the reforming sections of this new plant to conserve the potential energy of the natural gas feed. This contrasts with usual practices that produce low-pressure synthesis gas. Although the synthesis gas must be still further compressed before it is charged to the ammonia converters the new high-pressure reformer conserves about 25 to 35% in compressor horsepower.

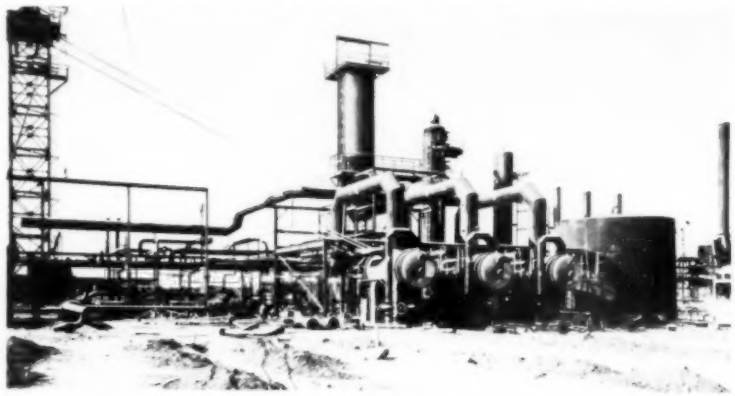
The section operates at about 100 psi and the over-all effect of the new design is economy in operation without loss of reaction efficiency. Further information on the Kellogg ammonia process is contained in a new booklet which is available on request from Kellogg's Chemical Process Division.

Work Progresses on Sasol Plant



Shown here are two major sections of the multi-million-dollar synthesis project now under construction by Kellogg in South Africa. While the primary purpose of the plant is to synthesize gasoline and other oil products from coal, it will also produce large volumes of valuable chemicals which will be purified in Kellogg-designed equipment. (Photo above shows fractionation equipment for both oil products and chemicals.)

Shown in its early construction stages (below) is the most important unit in the process sequence. This is the Kellogg Synthol unit which will catalytically convert synthesis gas to liquid hydrocarbon and chemical products.



NEW BOOKLET ON ETHYLENE

A new booklet on the production of ethylene from a variety of feed stocks has just been issued by Kellogg. It provides data on the use of Kellogg's unique steam pyrolysis process in cracking reduced crude, gas oil, naphtha, propane and ethane. For a copy write THE CHEMICAL PROCESS DIVISION, the M. W. Kellogg Company, 225 Broadway, New York City 7.

Typical Current Kellogg Chemical Plant Contracts in the fields of—

- ★ Ethylene
- ★ Polyethylene
- ★ Phenol-from-Cumene
- ★ Anhydrous Ammonia
- ★ Methanol
- ★ Phthalic Anhydride
- ★ Iso-octyl Alcohol
- ★ Liquid Fuel and Chemicals Synthesis from Coal
- ★ Glyceride Purification
- ★ Nitric Acid
- ★ Ammonium Nitrate
- ★ Ammonium Sulfate

For further information, technical data, etc., relating to chemical or petrochemical processing, write

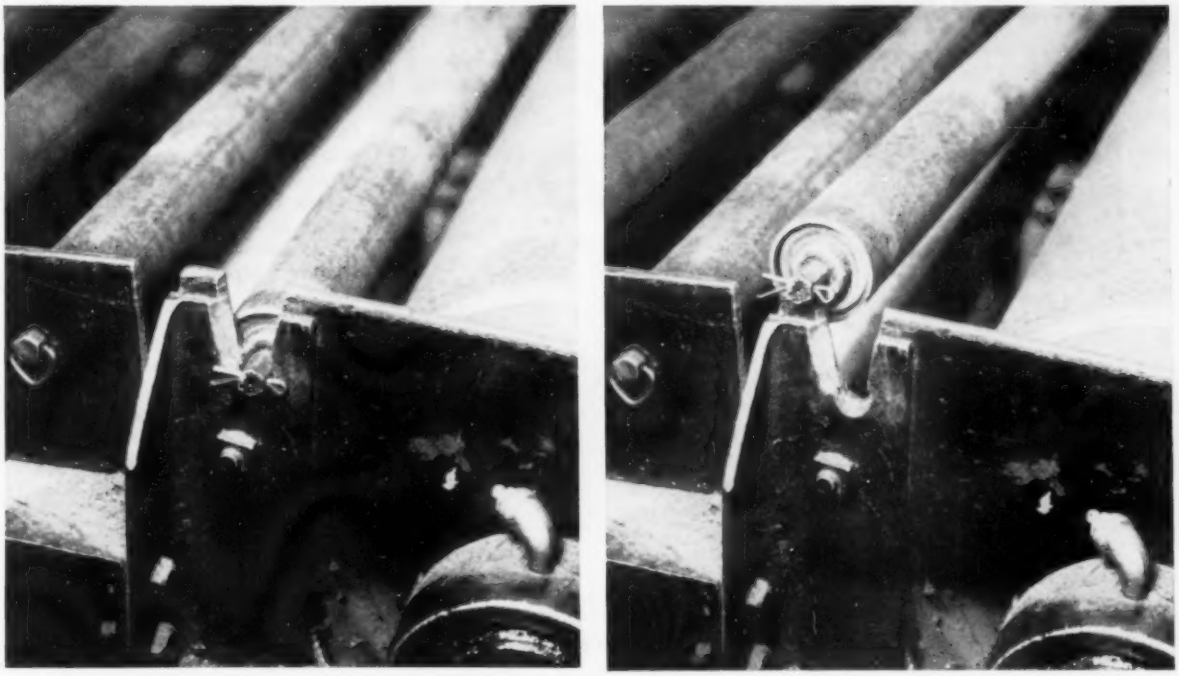
CHEMICAL PROCESS DIVISION

THE M. W. KELLOGG COMPANY

225 Broadway, New York 7, N. Y.

also Jersey City, Buffalo, Chicago, Los Angeles, Tulsa, Houston
in Canada—Toronto and Edmonton
in Europe—London and Paris

KELLOGG — A DIVISION OF PULLMAN INCORPORATED



DANGEROUS ROLLER KICKS OUT OF WAY if moving belt pulls the operator's hand into this drum conveyor

No Pinched Fingers in this Conveyor

A SIMPLE revision of the bearing for one roller on a drum conveyor has eliminated a serious accident hazard in the packaging department at Sinclair Refining Co.'s East Chicago, Ind., refinery.

Because thousands of drums and other containers are handled daily in this plant, the buildings are equipped with many different types of conveyors. At a number of locations in the drum storage area, men transferring drums from a conveyor are stationed at points where an endless belt type joins a roller type conveyor. Occasionally an employe would get his finger caught between the devices.

The solution to the problem is shown in the photographs. The first roller rests in a notch so that it can easily "kick out" as soon as a finger, or any object for that matter, slips off and is drawn down into the space by the motion of the belt.

Tips on Ball Bearing Maintenance

LUBRICATION is an all-important part in good maintenance for bearings of electric motors. Last month, the use of grease lubrication was discussed: this month will cover the use of oil.

This short article is a continuation of a series of questions and answers started several months ago dealing with this maintenance problem.

Source of this information is a seminar conducted at the Aruba, Netherlands West Indies, refinery of Lago Oil & Transport Co. by Mr. Jack Cannon, Continental Electric Co., and made available to PETROLEUM PROCESSING by Lago.

Why should a light oil be used to lubricate ball bearings?

The balls should roll around the inner race and inside the outer race. The function of the oil is to keep the balls and ball tracks from becoming oxidized or rusty. The balls must remove practically all the oil from the ball tracks before it can pass any given point. Therefore, a light oil offers less resistance to the rolling balls than does a heavy oil.

Is the oil level in a ball bearing housing important?

Yes, very important. If the level of the oil is too high, the bearing will run hotter than necessary. If it is too low, the bearing may not get any lubrication at all, which will cause a failure.

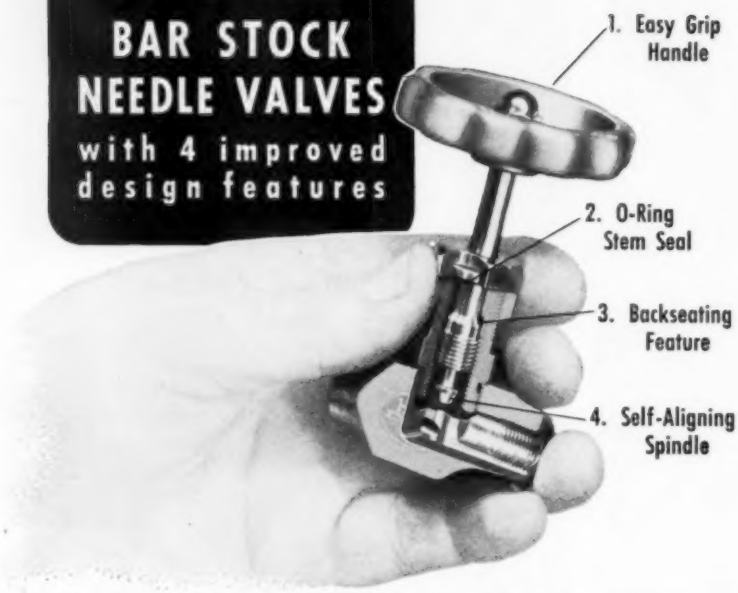
How often is it necessary to change the oil?

This depends upon conditions. A very highly refined light lube oil will last for years. If there are bad atmospheric conditions, such as acid fumes, flue gases, and the like; the oil may become contaminated. Such contamination will usually change the color of the oil and thus indicate when it should be changed.

Is there any exchange of oil between the oil bottle and the bearing reservoir?

There is a very slow "thermosyphon" action between the warm oil in the bearing housing and the cooler

NEW
HOKE
BAR STOCK
NEEDLE VALVES
with 4 improved
design features



The newest and most versatile bar stock needle valve now available—that's the HOKE 270 series for instrumentation, test panel and hydraulic service. The O-ring stem seal provides maximum tightness and eliminates packing adjustments. (Conventional packing is available, however, if desired.) An important new advantage is the backseating feature that permits O-ring or packing replacement under pressure, without shutting down. A self-aligning spindle has been designed to insure tight seating with minimum wear. The easy-grip handle is of die-cast anodized aluminum, with no sharp edges. An additional feature makes possible direct instrument panel mounting. These new bar stock valves are now available in sizes from ⅛" to ½" pipe — straight and angle patterns — manufactured from brass, Type 316 or 430F stainless steel. O-ring styles can be helium leak tested for use in non-critical high vacuum service.

Write for the New Hoke Catalog

This completely illustrated 68-page catalog contains specifications on needle valves of all sizes as well as toggle valves, special purpose valves, fittings and accessories. Tell us about your problem and we will gladly send you a copy of the catalog with our specific recommendations. Address your request to 161 S. Dean Street, Englewood, N. J.

HOKE
HOKE INCORPORATED
Fluid Control Specialists
ENGLEWOOD, NEW JERSEY

oil in the bottle. Although the proper oil level will not permit oil to run out of the bottle, this slow flow of oil goes on continuously. Within 24 to 36 hours, the contents of the oil bottle will be the same color and quality as the oil inside the bearing housing.

Is there any possibility that the lead-in pipe between the oil cup and the bearing housing may become plugged or stopped up?

This is always a possibility. The wrong oil, with too much free wax, can cause the pipe to become plugged. Gummy deposits from chemically-changed oil could plug the pipe if allowed to go too long without a check-up on the condition of the oil.

Can the material which wears off an oil ring damage a bearing?

The amount of bronze powder which will wear from an oil ring over a long period of time should not damage a bearing. This powdered metal usually settles at the bottom of the oil reservoir.

Sand is more of a problem with bearings at Aruba than other factors. What can be done about this?

It has not been proved that sand has been the cause of many bearing failures in the Aruba plant. However, it must be admitted that with the constant wind, there is considerable amount of coral sand carried in the air. The same conditions, however, apply to a great degree in areas like Texas and Oklahoma.

You should maintain close tolerances between the shaft and bearing caps. You should also check the grease

CASH for Your Ideas!

Want some cold, hard cash for your own maintenance ideas? They're always valuable—not only to your plant, but to others who have problems common to your own. PETROLEUM PROCESSING will pay you for your ideas, if accepted for publication, at our regular space rates—or even higher if your idea is really a hot one.

So take a look around the shop today. Then send the stuff in to us, along with drawings, photographs, or what have you. Don't worry about the writing. That's our job. The idea is the important thing. We can dress up the notes and the illustrations. Send your contributions to:

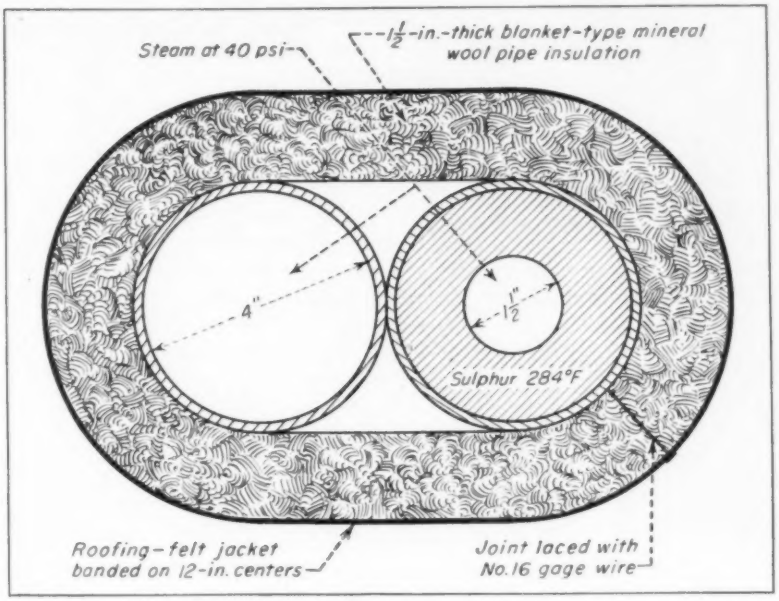
Plant Practices Editor
PETROLEUM PROCESSING
330 West 42nd Street
New York 36, N. Y.

(To obtain more data on advertised products see page 424)

by rubbing it between your fingers at regular intervals where a bad, sandy condition exists. This will not be necessary for oil-lubricated motors using light lube oils, because any sand entering the housing will settle to the bottom.

What can you do about "washboarding," caused when an oil ring fails to turn properly on the shaft?

If the oil ring will not turn freely on the shaft, it is usually caused by either too heavy an oil or some mechanical obstruction. For all oil-lubricated ball bearings you should use a light oil, which will never cause enough drag on the ring to prevent its turning. There are many different types of split oil rings used on pumps and sleeve bearings which account for excessive wear on the inside surface of the oil ring in irregular shapes. These problems can be solved only by an individual study of each case.



LOWER INSTALLATION COSTS can be realized if parallel lines are covered with one common blanket of insulation

Wrap Them Together to Save Heat

WHENEVER piping is parallel, close together, and contains materials that have compatible temperatures; it is frequently economical to insulate the entire group of pipes as a single unit.

Too often, pipe is installed to follow its own individual path in reaching process equipment and has to be insulated individually. Also, some pipe runs may be parallel but so short that savings in utilizing group insulation are small. However, the reduced cost of insulation and application time becomes significant when two or more lines are parallel in fairly long runs.

As an example, the insulating technique on a pair of parallel lines in a long elevated run at one eastern plant is detailed in the drawing. Process steam at 40 psi. (or 267° F.) and molten sulfur at 284° F. are being transported in the two 4-in. lines indicated. In addition, the sulfur line is internally traced by a steam line.

Mineral wool, blanket-type pipe insulation in 24-in. long sections was wrapped around both pipes, laced tightly at the joint with 16-gage, galvanized iron wire, and banded at about 12-in. intervals. A weather-resistant, roofing-felt jacket was then applied over the insulation and also banded on 12-in. centers. Because the lines are exposed entirely to the atmosphere, the insulation joint is located in the underside of the line, and the roofing felt is lapped downward about 3 in.

Whether parallel pipes are indoors or outdoors, and contain steam, molten sulfur, asphalt, or any other heated materials; flexible blanket type pipe insulation applied in this manner can maintain process temperatures efficiently at a lower initial cost.

—*Industrial Mineral Fiber Institute*

SET YOUR SIGHTS ON BEST RESULTS!

A number of industries have already discovered the way to increased profits and most expedient results by using Tennessee's highest quality Sulphur-Dioxide. Perhaps you, too, have a particular process in which our product can be used profitably. In most cases, a more satisfactory and economical operation is achieved through using this chemical (SO_2) with its manifold uses. We can supply Tennessee's highest quality Sulphur-Dioxide in cylinders, ton drums, tank cars and tank trucks. Let our own technical experts show you how you might utilize it to your greatest advantage and economy.

CONTAINERS

- Cylinders
- Ton Drums
- Tank Trucks
- Tank Cars

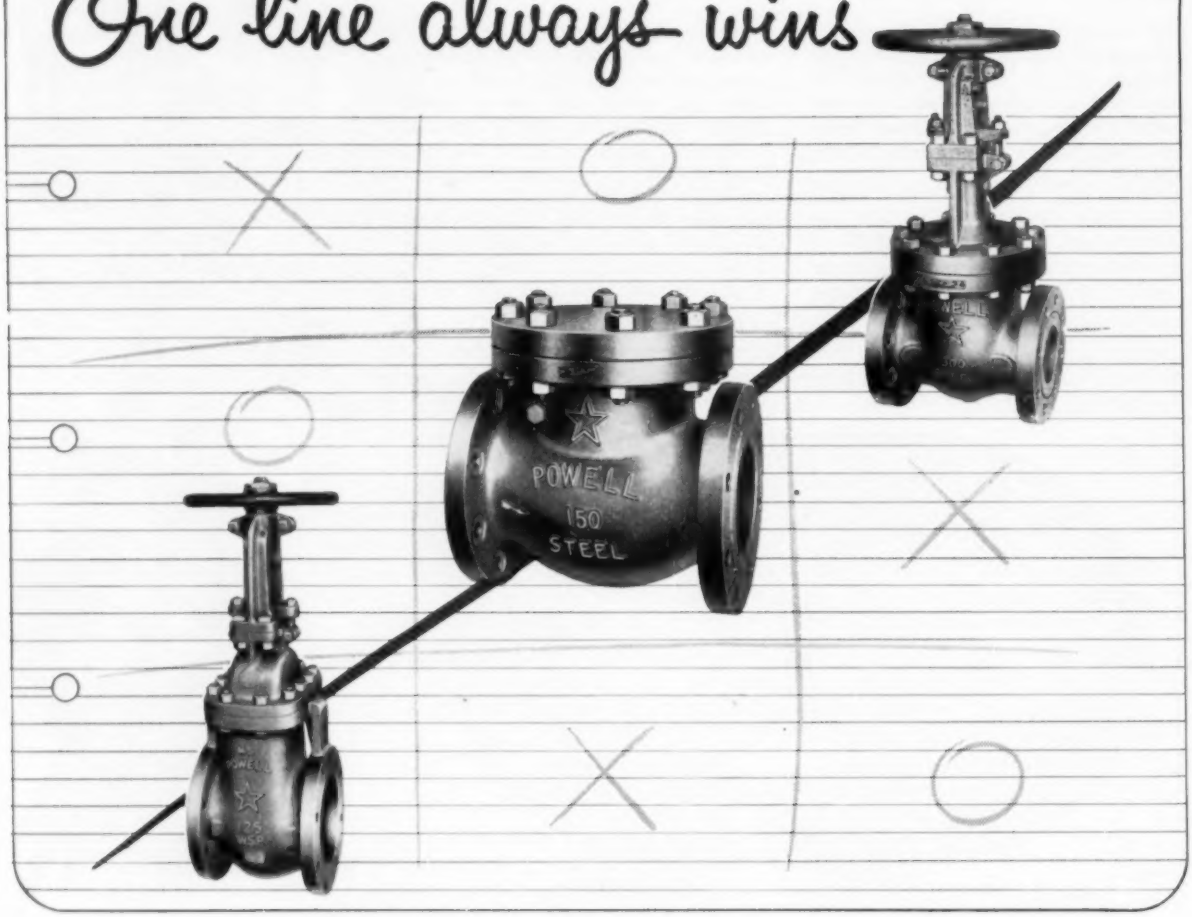
For detailed information, phone, wire or write—

TENNESSEE TC CORPORATION

617-29 Grant Building, Atlanta, Georgia

 (To obtain more data on advertised products see page 424)

One line always wins



TOP

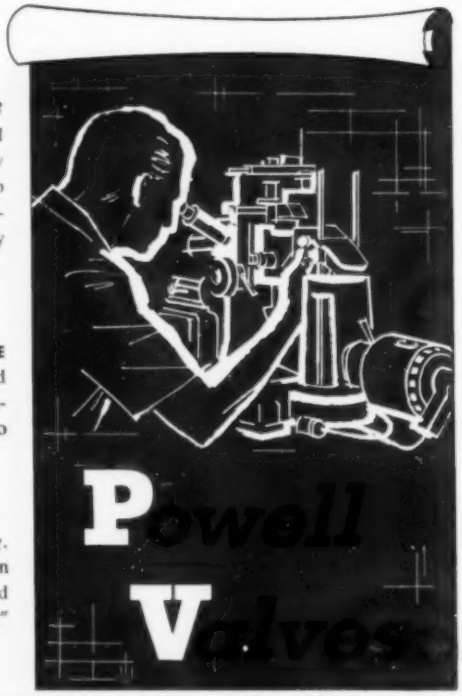
CAST STEEL GATE VALVE *(Fig. 3003 FE)* for 300 pounds W.S.P. Bolted flanged bonnet with outside screw rising stem and yoke. Sizes 1″ to 24″, inclusive. In addition to Carbon Steel, also available in Alloy Steels.

CENTER

CAST STEEL SWING CHECK VALVE *(Fig. 1561)*. 150 pounds. Bolted flanged cap. Heavy rugged construction. Available in sizes ¾″ to 18″, inclusive.

BOTTOM

"MODEL STAR" GATE VALVE *(Fig. 1793)* for 125 pounds W.P. Iron body, bronze mounted. Supplied with taper solid wedge. Sizes 2″ to 30″, inclusive.



There's never any doubt about what tack to take in choosing the winning line of valves. It's Powell! For Powell Valves are manufactured up to The William Powell Company standards of quality—standards that have kept rising for more than a century.

What's more, Powell has a *complete line*—probably manufacturing more types of valves than any other organization in the world.

Powell Valves are available through distributors in principal cities. If a distributor is not located near you, just write us. We'll be pleased to tell you about our complete line and answer your questions. Answering questions is a specialty at Powell where solving valve problems has built the world's most valuable background of sound solutions.

CONTROLS FOR THE LIFE LINES OF INDUSTRY

.....108th YEAR

THE WM. POWELL COMPANY · CINCINNATI 22, OHIO

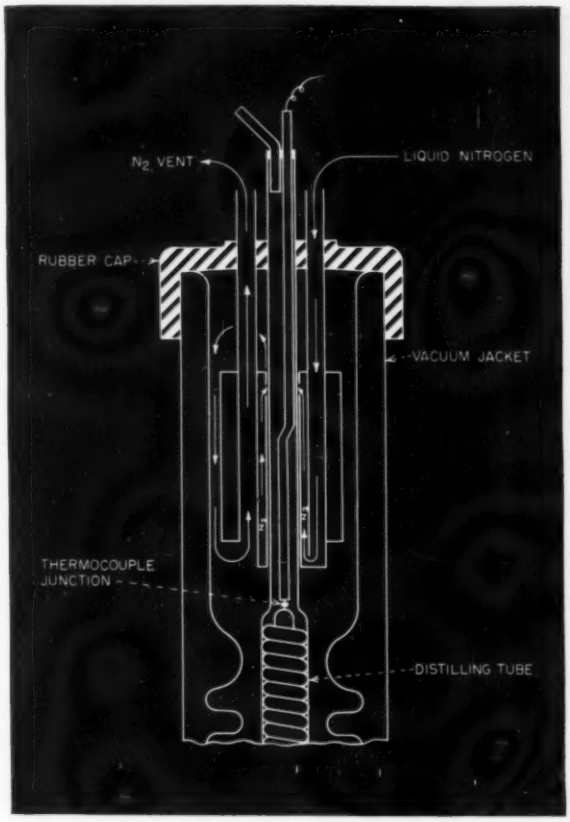


FIG. 1—Original reflux cooling system on fractional analysis apparatus

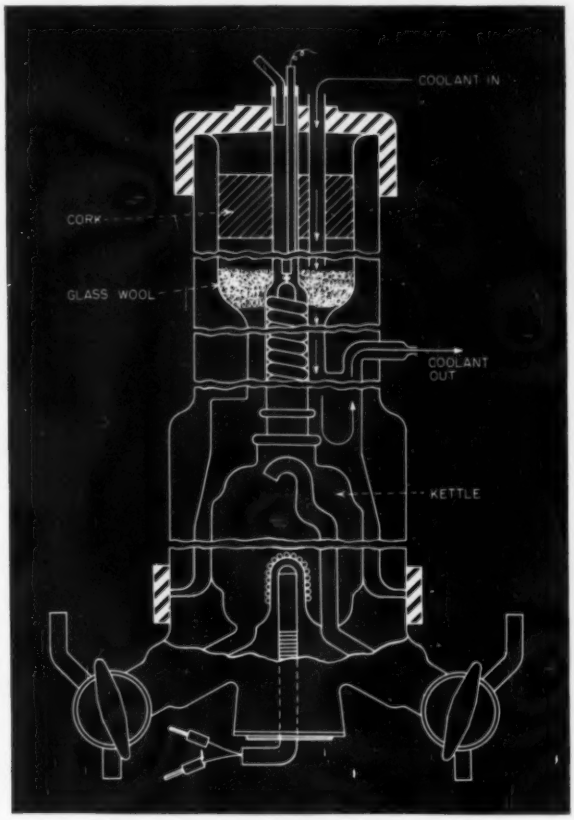


FIG. 2—Modified reflux cooling system which eliminated the liquid hold-up problem

Modified Apparatus Ups Analysis Accuracy

IN most fractional analysis apparatus, any liquid hold-up which may exist in the column cannot be corrected by calibration and may introduce an appreciable error.

Hold-up can occur because the gas at the measuring junction of the thermocouple at the head of the column is at a dew point; thus, any cooling of the column section above the thermocouple junction must result in condensation of some liquid from the gas stream. For the column used in Podbielniak automatic and semi-automatic fractional analysis equipment, liquid hold-up can be removed by making a change in the condenser section of the column. Modifications of this method will probably be appropriate for use in other columns.

Fig. 1 shows a schematic drawing of the cooling section of the column as supplied by the manufacturer. Liquid nitrogen is forced by air pressure from a Dewar flask into the metal nitrogen vaporizer where its latent heat is absorbed. The resulting gaseous nitrogen is led through four small holes against the distilling tube and out through the vent at the top of the column. The position of these holes against the distilling tube and above the thermocouple results in a cold spot for the possible condensation of liquid, and it has been observed at this point.

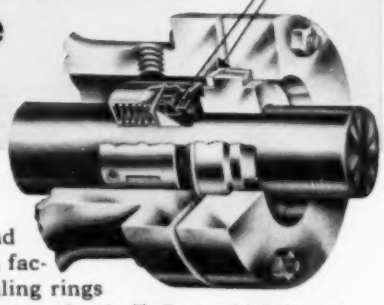
Of the several modifications tried to eliminate liquid hold-up, the most successful was replacing the metal vaporizer with the arrangement shown in Fig. 2. A cork terminating about a quarter inch above the thermocouple junction fits around the distilling tube. A tube extends through the cork and a wad of glass wool is placed at the point where the vacuum jacket narrows down to a close fit around the distilling tube.

When the analysis is proceeding on a sample containing no components more volatile than ethane, the cooling is effected entirely by vapor; that is, dry air or nitrogen passes through the Dewar flask of liquid nitrogen. The resulting cold dry gas goes through the hole in the cork into the condenser section, through the plug of glass wool, down around the distilling tube and finally out through the side outlet on the column. Thus, some cooling is effected over the entire length of the distilling section and the cold vapor is led down the column to eliminate any possibility of cooling above the thermocouple junction.

If the sample being analyzed contains components more volatile than ethane, the sensible heat of the cold gas is insufficient for their condensation. Hence, liquid nitrogen is introduced through the tube in the cork and vaporized on the plug of glass wool. Again, the vapors from the nitrogen pass down around the column and out the side outlet, rather than out the top of the column. This cooling method

new JOHN CRANE mechanical seal with TEFLON*

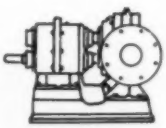
Solves Corrosion and Temperature Problems...



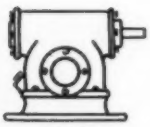
With the new Type 9 John Crane Mechanical Seal, proper sealing of chemicals and corrosive liquids is no longer a factor. Its flexible wedge and sealing rings are molded of the remarkable new plastic Teflon, which is not affected by any industrial chemical.

The successful development of two years research and field testing, this revolutionary seal handles corrosive liquids never before controlled effectively by conventional, flexible type mechanical seals. Thus, John Crane designing experience is effectively combined with the unique properties of Teflon: chemical inertness, extremely low friction and high heat resistance. Type 9 Seal can be employed at temperatures up to 500°F.

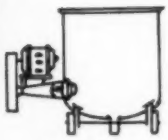
WRITE TODAY FOR *NEW* BOOKLET
describing the John Crane Type 9 Shaft Seal. Crane Packing Co., 1832 Cuyler Ave., Chicago 13, Illinois.



PUMPS



SPEED REDUCERS



MIXERS AGITATORS

* Registered DuPont Trade-mark for tetrafluoroethylene resin

JOHN CRANE CRANE PACKING COMPANY

has effectively eliminated liquid hold-up, as established both by the analytical accuracy obtained with synthetic samples and by observation of the top of the column.

At the same time these changes were made in the arrangement of the apparatus for cooling the top of the column, changes were made in the electronic circuit controlling automatic cooling so that part of the column cooling was on continuously and a part came on as required to maintain the column pressure at the desired value. The continuous cooling had the effect of steadying the column operation, always a desirable feature in analytical distillations.

The cooling method as finally evolved appears to improve the sharpness of fractionation over that which would be expected from the elimination of liquid hold-up and some steadying of column operation.

The column appears to run quite lean; that is, less liquid reflux is in the column than normally observed. At the same time, the breaks between components are sharper than usually obtained. Exactly why the column separating efficiency is improved by these changes is not known at present.

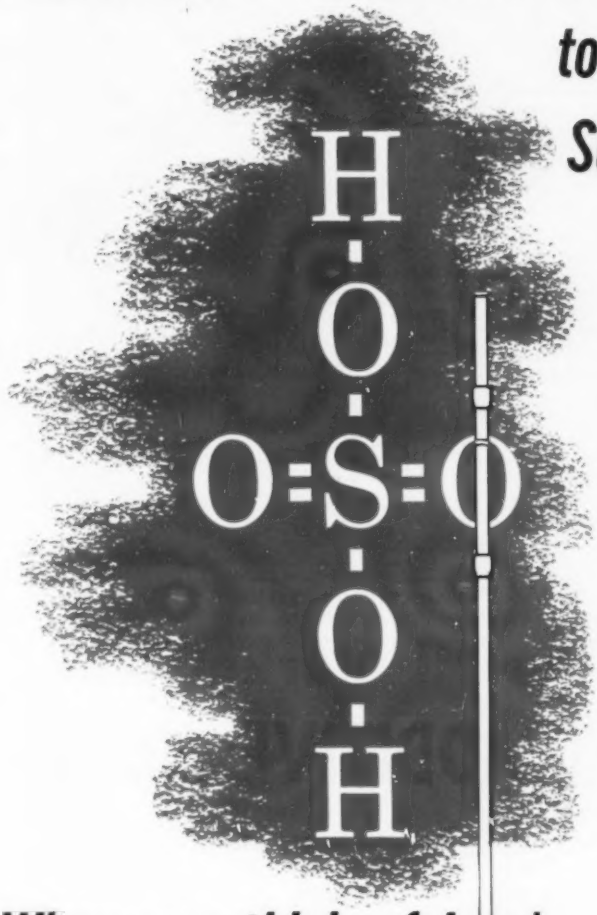
The adaptation of this method of column cooling to equipment other than the Podbielniak apparatus is not straightforward. The California Natural Gasoline Association column, for example, uses the outer wall of the distilling tube as the inner wall of the vacuum jacket. Therefore, there is no annulus between the distilling section and the vacuum jacket through which to lead the cold vapor. However, the method described above was quite effective. It might be desirable to modify other types of distillation equipment to allow this type of cooling to be used.

One other change made in the Podbielniak equipment which increased the efficiency of separation is the addition of a second thermocouple about 1 in. down into the packing. This thermocouple and the normal top thermocouple are both wired to the recorder through a commutating switch. The switch is so operated that the top thermocouple is recording two-thirds of the time; the lower thermocouple, one-third of the time.

The lower thermocouple activates the temperature rise circuit in the recorder before the temperature rise reaches the top thermocouple. Thus, the distillation is automatically slowed down before the break between components reaches the top of the column. This feature is particularly helpful in obtaining sharp breaks on the isomer separations.

(To obtain more data on advertised products see page 424)

When *is Lead used to control Sulphuric Acid Corrosion?*



Sulphuric acid is like "Peck's Bad Boy."

It has plenty of outstanding qualities, but it's hard to control.

Ordinarily, lead is the metal used by industry to keep sulphuric acid corrosion within limits. Lead is often used when H_2SO_4 concentrations go as high as 96% at room temperature or as high as 85% at 220 degrees Centigrade.

When making equipment to handle H_2SO_4 within such ranges, lead will usually give you the most practical combination of corrosion resistance, simple fabrication, and reasonable cost. No common metal is easier to work than lead and it is economical, both in first cost and in maintenance.

With other corrosives the detail differs but the story is much the same. So when you think of corrosion resistance, think of lead and . . .

When you think of Lead . . . think of National Lead

WHAT GOES FOR LEAD AND H_2SO_4 GOES FOR LEAD AND HUNDREDS OF OTHER CORROSIVES

National Lead puts lead in your hands in any grade you may require and in every conceivable form — sheet, pipe, coils, fittings, valves, pumps and vessels. Or you can have National Lead fabricate lead equipment to your specifications.

So put National Lead first in your thinking when you want to combat corrosion. Call on National Lead for technical assistance. Ask for a copy of the new booklet on "Chemical Lead Products."

National Lead Company

New York 6; Atlanta; Baltimore 3; Buffalo 3; Chicago 8; Cincinnati 3; Cleveland 13; Dallas 2; Philadelphia 25; Pittsburgh 12; St. Louis 1; Boston 6 (National Lead Co. of Mass.); Los Angeles 23 (Morris P. Kirk & Son, Inc.); Toronto, Canada (Canada Metal Company, Limited).

*Reg. U.S. Pat. Off.

(To obtain more data on advertised products see page 424)

Just look at the difference...

Figs. 1 and 2 are representative of results obtained in a test conducted by a major oil company in an area where an abnormal number of sludge complaints in domestic heating systems were received.

Fig. 1 shows a typical filter element as removed from one of the heating units after running on untreated fuel. Fig. 2 shows an element at the end of a 90-day test period in which the same fuel plus Fuel Oil Additive No. 2 had been used in the system.

This, and other findings in the test, indicated that Du Pont Fuel Oil Additive No. 2 acts as an active sludge dispersant in concentrations of 20 lbs./1000 barrels and that its use in dirty fuel oil systems is generally beneficial.

Increase your heating oil market with

DU PONT FUEL OIL ADDITIVE No. 2

The prevention of filter clogging is an important sales and servicing advantage . . . and customer satisfaction is becoming increasingly important in every heating oil market. One way of assuring this satisfaction is in the prevention of clogged filter screens or lines.

To help overcome clogging, Du Pont Fuel Oil Additive No. 2 not only retards the formation of insoluble residues, but also reduces the particle size of those residues that *are* formed.

Actual field tests, of which the filter elements illustrated above are a part, show also that Fuel Oil Additive No. 2 acts as a sludge dispersant in dirty fuel systems and, being ashless, burns completely with the fuel.

If you want to insure a higher quality fuel oil for next fall's market, why not start by giving it added storage stability *now* with Du Pont Fuel Oil Additive No. 2.

Samples for testing in your own stocks and a descriptive booklet on this additive can be obtained from any Du Pont Petroleum Chemicals Division representative or regional office.

DU PONT
REG. U.S. PAT. OFF.

Better Things for Better Living
. . . through Chemistry

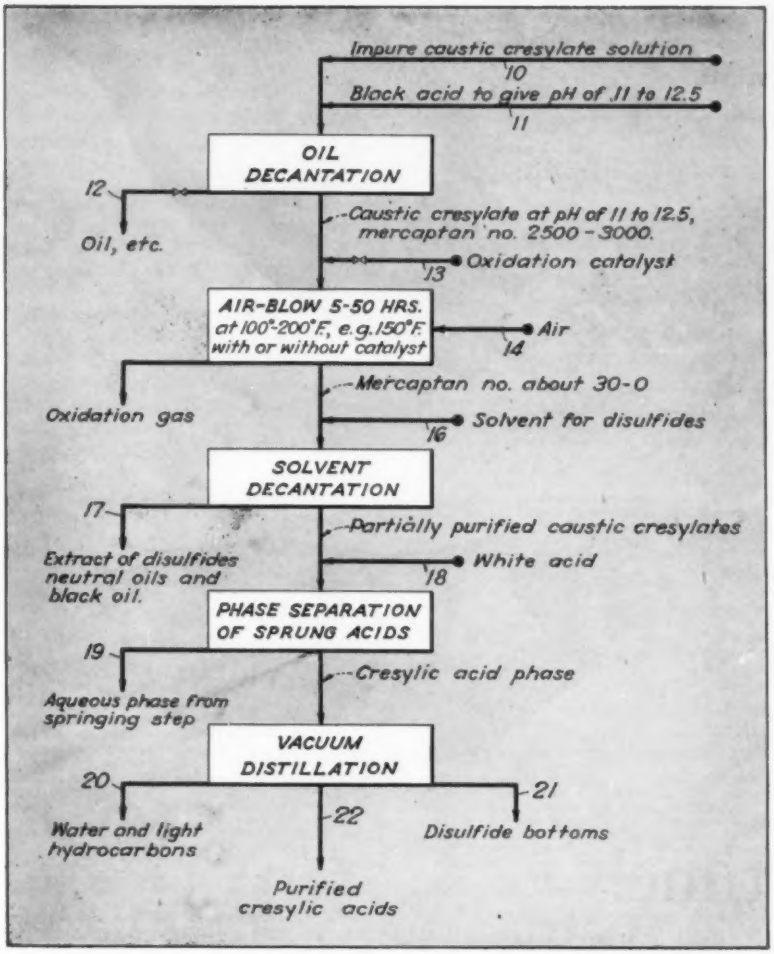
Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • Wilmington 98, Delaware

Regional Offices:
NEW YORK, N. Y.—1270 Ave. of the Americas . . . Phone COlumbus 5-3620
CHICAGO, ILL.—8 So. Michigan Blvd. . . . . Phone RAndolph 6-8630
TULSA, OKLA.—1811 So. Baltimore Avenue . . . . . Phone Tulsa 5-5578
HOUSTON, TEXAS—705 Bank of Commerce Bldg. . . . . Phone PRestan 2857
LOS ANGELES, CALIF.—612 So. Flower St. . . . . Phone MAdison 1691

IN CANADA: Canadian Industries Limited—Toronto, Ont.—Montreal, Que.—Calgary, Alta.
OTHER COUNTRIES: Petroleum Chemicals Export—Nemours Bldg., 6539—Wilmington 98, Del

By Peter J. Gaylor, Patent Attorney, Newark, N. J.



CRESYLIC ACIDS are the end product of this Indiana Standard process for purifying caustic cresylate solution resulting from the treatment of cracked gasoline (U.S. 2,635,120)

Purified Cresols Can Be Recovered From Caustic Cresylate Solution

CAUSTIC treatment of cracked gasoline generally results in accumulation of "phenols" which often are dumped. According to a patent (2,635,120) issued to Standard Oil Co. (Ind.), these cresylates may be treated to produce a purified form of cresols.

The process is illustrated diagrammatically in the flowsheet shown above. Crude caustic cresylate solution 10, say in amount of 36,000 gal. and having an initial pH of about 13, is treated with about 5400 gal. of black acid 11 (about 40% sulfuric acid previously used for treating petroleum oils). This partial neutralization brings the pH to about 11.6 and may liberate some oil which is decanted through line 12.

Then, about 300 lbs. of nickel sulfate are added as an oxidation catalyst 13, and the solution is blown with air 14 for less than 50 hrs. at 110°-150° F, decreasing the mercaptan number from about 2800 to about zero. The thus sweetened cresylates, now containing disulfides, are washed with two 300 gal. dumps of a solvent 16 (light naphtha) for removing as extract 17 most of the disulfides, neutral oil and black oil originating from the black acid. About 90-95% of the disulfides are removed in this manner, together with neutral oils.

The resulting partially purified cresylates are sprung by addition of 2300 gals. of commercial 40% white sulfuric acid 18, and the aqueous layer 19 is withdrawn from the cresylic acids, which are vacuum distilled to remove an overhead fraction 20 (water and light hydrocarbons). The purified cresylic acids 22 also are taken overhead, leaving the disulfide bottoms 21 as residue. The sprung acids prior to vacuum distillation have a total sulfur content of 0.313%, a neutral oil content of 2%, a copper number of 0, a specific gravity of 1.052, a water content of 14.4% and a pH of 9.1. The distilled cresylic acid has a sulfur content of .062%.

Use Sulfur Compounds for Selective Desulfurization

THE adage of "like tends to beget like" is applied in the process disclosed in patent 2,664,385 issued to Standard Oil Co. (Ind.), in which sulfur compounds of limited solubility are employed to extract sulfur compounds from petroleum stocks. A series of tests (such as those shown in the tabulation below) revealed that methanethiolsulfonate esters show the highest S S F (sulfur selectivity factor) of the solvents tested.

Solvent	Vol.-% extract on 100% treat	Sulfur Selectivity factor
Methyl methanethiolsulfonate	16	240
Nitromethane	13	200
Furfural	26	220
Dimethyl formamide	40	160
Sulfur dioxide	35	210
C_2H_5—SO—C_2H_5	36	160

The sulfur selectivity factor is derived as follows:

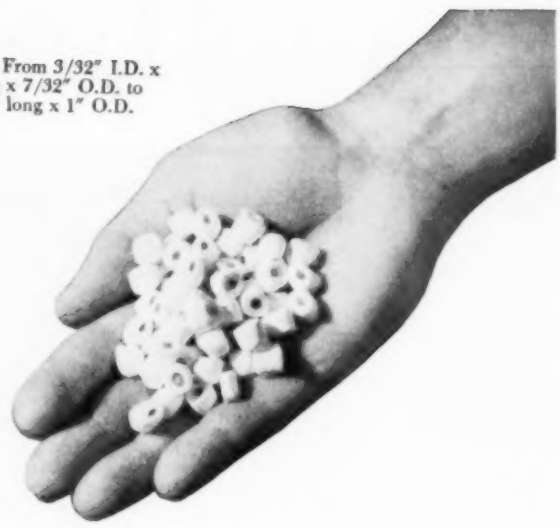
$$SSF = \frac{\%\,S \text{ in feed} - \%\,S \text{ in raffinate}}{\text{vol.-\% extracted}} \times 104$$

It will be observed that methyl methanethiolsulfonate is superior in sulfur selectivity to all of the excellent liquid solvents, including SO_2.

However, it will be noted that a solvent has yet to be discovered which will extract sulfur compounds with only small amounts of accompanying hydrocarbon material. In the present case, a catalytic cycle stock containing 1.10% sulfur, when extracted with an equal volume of phenyl benzene thiolsulfonate, produced a raffinate layer equal to 30% by volume of the total mixture, containing 0.66% sulfur. It

RINGS. *Sizes:* From 3/32" I.D. x 3/16" long x 7/32" O.D. to ½" I.D. x 1" long x 1" O.D.

PELLETS. *Sizes:* From ⅛" x ⅛" to ½" x ½".



ENGINEERED **℞** PRESCRIBED

SPHERES. *Diameters:* ¼" to 1".

for shorter contact time!

Norton specially engineered carriers bring proved advantages to a wide range of processes

Whatever your specific application may be, it will pay you to investigate the many advantages of Norton catalyst carriers.

Made of ALUNDUM* (fused alpha alumina), these highly refractory carriers are outstanding for heat conductivity, chemical stability in both oxidizing and reducing atmospheres, mechanical strength and abrasion-resistance. And Norton's exclusive *controlled structure* process offers you a choice of porosities. In pellets and rings, porosities range from medium to high. In spheres, porosities range from medium, with rough exterior for coating with catalyst . . . to high, with a network of open pores and rough exterior for impregnating with catalyst.

Chemical engineers are finding this Norton "R Refractory Prescription" invaluable in processing many different products. For example, in meeting the rapidly growing demand for phthalic anhydride, Norton catalyst carriers aid in shortening catalyst contact time and in achieving the highly exothermic reaction in fixed bed converters.

Test Them Out

Find out just what Norton ALUNDUM catalyst carriers can do for you. See your Norton Representative for samples, or write to NORTON COMPANY, 262 New Bond Street, Worcester 6, Mass. for a free copy of Sales Engineering Bulletin #7.

Canadian Representative: A. P. Green Fire Brick Co., Ltd., Toronto, Ontario.

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

NORTON
REFRACTORIES
ENGINEERED ℞ PRESCRIBED
Making better products... to make other products better
NORTON COMPANY, WORCESTER 6, MASSACHUSETTS

(To obtain more data on advertised products see page 424)

is apparent, then, that some way must be found for utilizing the large amount of extract recovered.

There also appears to be a problem of removing the remaining solvent (about 0.1%) in the raffinate, which is effected in one example of the patent by extraction with concentrated hydrochloric acid.

Patents Issued Recently

The following classified listing gives the patent number, patentee, or assignee, and a brief description of all patents believed to be of interest to the petroleum processing industries, as contained in the Official Gazette of the U.S. Patent Office for December 22, 29, 1953, Vol. 677, Nos. 4-5, and January 5, 12, 19, 1954, Vol. 678, Nos. 1-3.

PROCESSES

Refining

2,663,169 (Lee S. Twomey) Manipulation of nitrogen-contaminated natural gases.
2,663,626 (J. F. Pritchard & Co.) Method of storing gases
2,663,669 (Socony-Vacuum Oil Co., Inc.) Method of stabilizing raw gasoline.
2,663,670 (Socony-Vacuum Oil Co.) Solvent extraction of aromatic hydrocarbons with fluorocarbon.
2,663,671 (Marathon Corp.) Method of breaking a urea complex.
2,663,673 (Standard Oil Co.) Desulfurization of petroleum oils with asphaltenes.
2,663,674 (Standard Oil Co.) Refining sour hydrocarbon oils with non-alkaline methanol and copper compound.
2,664,170 (National Tank Co.) Dual control separation of gas and oil.
2,664,345 (Fluor Corp., Ltd.) Manufacture of sulfur from H_2S-hydrocarbon containing gases.
2,664,384 (Phillips Petroleum Co.) Propane fractionation of reduced crude oil (de-asphalting).
2,664,385 (Standard Oil Co.) Extraction of sulfur compounds with thiolsulfonic esters.
2,664,968 (Standard Oil Development Co.) Process for recovering vapors and solids from gas streams (dehumidifying and scrubbing).
2,665,239 (M. W. Kellogg Co.) Refining catalyst-laden hydrocarbons.
2,665,246 (Sun Oil Co.) Electrostatic BF_3 sludge precipitation.
2,665,259 (Attapulgus Minerals and Chemicals Corp.) Absorbent and process for preparation thereof (attapulgite).
2,665,315 (Standard Oil Development Co.) Adsorptive distillation for separating close-boiling hydrocarbons.
Re.23,768 (California Research Corp.) Selective solvent extraction of petroleum vapors to separate aromatics.
2,666,019 (Socony-Vacuum Oil Co.) Method for recovering propane and heavier hydrocarbons.
2,666,020 (The Texas Co.) Separation of wax-like constituents from oil with a complexing agent (urea) in the presence of water.
2,666,022 (Phillips Petroleum Co.) Hydrocarbon process for reducing the pour point of a topped crude oil by cracking with silica-alumina catalyst etc.
2,666,048 (The Texas Co.) Separation of low molecular weight hydrocarbons from hydrocarbon mixtures with a complexing agent (urea).
2,666,500 (Standard Oil Development Co.) Cyclic adsorption process.
2,666,730 (Phillips Petroleum Co.) Dewaxing process employing filtering.
2,666,739 (Standard Oil Development Co.) Electrical coalescense process.
2,666,794 (Phillips Petroleum Co.) Desulfurization of hydrocarbons by extraction with phenylacetonitrile.

Catalysts

2,663,620 (Universal Oil Products Co.) Preparation of alumina from aluminum chloride hexahydrate.
2,663,676 (Standard Oil Development Co.) Catalyst recovery in fluidized system
2,664,404 (Standard Oil Development Co.) Regeneration of Pt selective hydrogenation catalyst.
2,665,258 (Houdry Process Corp.) Bead-forming process.
2,666,524 (Socony-Vacuum Oil Co.) Process for separating bead-like gel particles.
2,666,749 (Universal Oil Products Co.) Spheroidal alumina.

Conversions

2,663,675 (Shell Development Co.) Conversion of hydrocarbon oils (thermal-catalytic cracking).
2,663,677 (Houdry Process Corp.) Catalytic cracking of hydrocarbons.
2,663,678 (Phillips Petroleum Co.) Decoking of pebbles in pebble heater cracking of hydrocarbons.
2,664,336-7 (Gulf Oil Corp.) Fluidized fixed bed process.
2,664,339 (Gulf Oil Corp.) Catalytic conversion having neutral to exothermic heat balance.
2,664,346 (Hydrocarbon Research, Inc.) Fluid reactor.
2,664,386 (Universal Oil Products Co.) Two-stage process for the catalytic reforming of gasoline.
2,664,389 (Standard Oil Development Co.) Process and apparatus for the distillation of solids.
2,664,390 (The Texas Co.) Carbonizataion of coal.
2,664,394 (Phillips Petroleum Co.) Electrochemical conversion of hydrocarbons (mainly propane) to isoparaffins.
2,664,451 (Phillips Petroleum Co.) Process of dehydrogenation in presence of alumina.
2,664,452 (Stratford Engineering Corp.) Process for alkylation utilizing evaporative cooling.
2,664,967 (Standard Oil Development Co.) Method for contacting gaseous material with finely divided solids in fluidized system.
2,665,172 (Sun Oil Co.) Apparatus for pneumatically elevating contact material.
2,665,200 (Hydrocarbon Research, Inc.) Process for the gasification of solid carbonaceous materials.
2,665,238 (The Texas Co.) Recovery of oil from shale.
2,666,086 (Phillips Petroleum Co.) Preparation of iron dehydrogenation catalysts.
2,666,526 (Standard Oil Development Co.) Process and apparatus for separating mixed materials in fluidized system.
2,666,528 (Universal Oil Products Co.) Treating chamber having solid bed.
2,666,692 (Phillips Petroleum Co.) Catalytic reactor tube assembly.
2,666,731 (Socony-Vacuum Oil Co., Inc.) Method and apparatus for hydrocarbon conversion using granular contact material.
2,666,732-3 (Standard Oil Co.) Method of treating hydrocarbons with a double-function catalyst used in treating lube oil, then for cracking.
2,666,734 (Phillips Petroleum Co.) Apparatus for conversion of residual oils, using pebble heater.
2,666,771 (Food Machinery and Chemical Corp.) Catalyizing organic isomerization reactions of olefins with active magnesia.
2,666,798 (Phillips Petroleum Co.) Olefin isomerization.

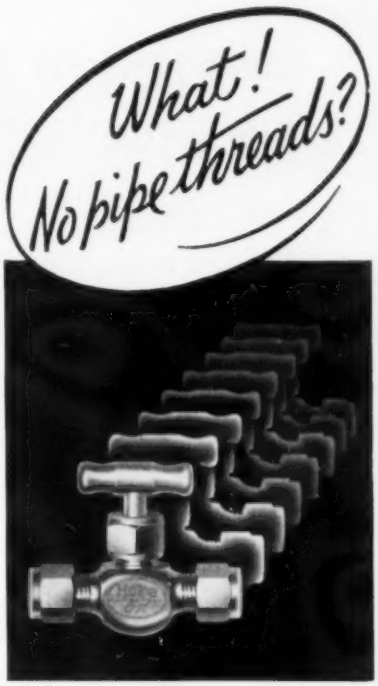
Hydrocarbon Synthesis

2,664,402 (Phillips Petroleum Co.) Protection of refractories in a hydrocarbon synthesis reaction system from high temperatures by blanketing gases.
2,664,433 (Phillips Petroleum Co.) Catalytic synthesis of organic compounds, using fluidized beds.
2,664,434 (Phillips Petroleum Co.) Recovery of oxygenated organic compounds from synthesis products.
2,664,435 (M. W. Kellogg Co.) Separation of organic compounds (alcohols).
2,665,199 (Standard Oil Development Co.) Process for producing hydrogen and carbon monoxide from gaseous hydrocarbons.
2,665,289 (Hydrocarbon Research, Inc.) Catalytic synthesis of hydrocarbons.
2,665,290 (M. W. Kellogg Co.) Separation of oxygenated organic compounds.
2,665,980 (The Texas Co.) Process for generation of carbon monoxide.
2,666,077 (M. W. Kellogg Co.) Process for hydrogenation of carbon monoxide.

PRODUCTS

Chemicals

2,663,379 (Phillips Petroleum Co.) Apparatus for hydrocarbon determination.
2,663,426 (Standard Oil Development Co.) Process for improving alcohol quality.
2,663,622 (Standard Oil Development Co.) Preparation of carbon disulfide from sulfur and hydrocarbon.
2,663,679 (Standard Oil Development Co.) Extractive distillation of alcohols obtained from olefins.



HOKE VALVES WITH
Swagelok®
ENDS

Now they are available from stock at Crawford Fitting Company and all Swagelok Distributors. These valves, manufactured by Hoke, Incorporated, Englewood, N. J., are equipped with Swagelok ends to provide leakproof and torque-free seals on every type of instrumentation installation. The arrow on the valve body shows direction of flow.

Hoke valves equipped with Swagelok ends are made in brass, aluminum, steel and stainless steel in sizes to meet your requirements. For further information and Swagelok catalog address Department 692.

Here's how the Swagelok fitting functions.

CRAWFORD FITTING CO.
884 East 140th Street Cleveland 10, Ohio
Teletype CV-783

(To obtain more data on advertised products see page 424)

must you pay a premium price for accurate instrumentation?

fielden says, "no!"—

with precise yet sensibly priced instruments like this TELSTOR Electronic Level Indicator. TELSTOR measures continuously—with accuracies to ±2% —the levels of liquids, viscous fluids, powders or granular solids. Remote readings can be recorded at distances greater than one mile.

Fielden TELSTOR Electronic Level Indicator for Accurate, Continuous Level Measurement of Liquids or Divided Solids.

Simplification is the reason for Fielden's economical instrumentation. TELSTOR, for example, has no moving parts—no floats to stick or leak —no pneumatic or hydraulic piping. Circuitry is simplicity itself and only one vacuum tube is employed. Measuring electrode and instrument are easily installed.

Unless you really *need* instrumentation of *extreme precision* (which inevitably costs more) get the facts about Fielden. *Simplified* Fielden instrumentation assures *all the accuracy you can use*—at an extremely worthwhile saving in initial cost and maintenance.

DOLLAR FOR DOLLAR—YOUR BEST INSTRUMENT VALUE

SEND FOR NEW INSTRUMENT DATA TODAY.

Fielden

INSTRUMENT DIVISION

ROBERTSHAW-FULTON CONTROLS COMPANY

2920 N. 4th St., Dept. K, Philadelphia 33, Pa.

Send full details of Fielden simplified ☐ TELSTOR Electronic Level Indicator ☐ TEKTOR Electronic Level Control ☐ TEKTOLOG Electronic Recorder.

*Name*_____

*Title*_____

*Company*_____

*Address*_____ *City*_____ *State*_____

Fielden TEKTOR Electronic Level Control

Fielden TEKTOLOG Electronic Recorder

Patents

2,663,701 (Shell Development Co.) Process for polymerizing certain unsaturated compounds in an aqueous system.
2,663,703 (Standard Oil Co.) Purification of straight-chain monohydric alcohols.
2,663,720 (Ethyl Corp.) Preparation of organic esters.
2,663,724 (Universal Oil Products Co.) Noncatalytic condensation of aromatic compounds with unsaturated organic compounds (side chain alkylation).
2,663,740 (Hercules Powder Co.) Oxidation of aromatic hydrocarbons to tert. hydroperoxide.
2,663,744 (Socony-Vacuum Oil Co., Inc.) Catalytic hydration of olefins.
2,663,745 (Standard Oil Development Co.) Process for improving alcohol quality.
2,663,746 (Universal Oil Products Co.) Dehydrogenation of a naphthenic hydrocarbon containing a geminal carbon atom, using Pt catalyst.
2,664,342 (Shell Development Co.) Pure hydrogen halide production by reaction of chlorine with hydrogen.
2,664,348 (Phillips Petroleum Co.) High pressure and temperature reaction chamber.
2,664,414 (Shell Development Co.) Monomers and polymers of unsaturated thioethers.
2,664,415 (Sun Oil Co.) Polymerizataion of butadiene-1,3 compounds in presence of K naphthenates.
2,664,440 (California Research Corp.) Separation of isophthalic and terephthalic acids from their mixtures.
2,664,447-8 (Hercules Powder Co.) Oxidation of aromatic hydrocarbons to ter-hydroperoxide.
2,664,450 (Badische Anilin-& Soda-Fabrik Aktiengesellschaft) Process for the production of acetylene by incomplete combustion of hydrocarbons.
2,665,241 (Cities Service Oil Co.) Concentration of aqueous formaldehyde solutions at low pressure.
2,665,269 (Phillips Petroleum Co.) Emulsion polymerization of vinylidene compounds in the presence of trisubstituted hydroperoxymethanes having 10 to 30 carbon atoms.
2,665,270 (Petrocarbon Ltd.) Process for preparing copolymers of styrene and divinylbenzene.
2,665,272 (Phillips Petroleum Co.) Emulsion polymerization at low temperatures in the presence of certain trialkylhydroperoxy methanes.
2,665,280 (Standard Oil Co.-Ind.) Halogen cleavage of ozonides.
2,665,288 (Standard Oil Development Co.) Process of promoting catalytic reactions in the vapor phase in gas form fluid stream.
2,665,293 (Standard Oil Co.) Preparation of the ethyl esters of sulfonic acids.
2,665,305 (Standard Oil Development Co.) Treatment of sulfonyl chlorides.
2,665,971-2 (Standard Oil Development Co.) Production of pure carbon dioxide using fluidized technique.
2,665,974 (Jefferson Lake Sulphur Co.) Apparatus for the recovery of elemental sulfur in liquid form from gases containing hydrogen sulfide.
2,666,025 (Shell Development Co.) Process for polymerizing vinyl-type compounds by irradiation with light.
2,666,034 (Tide Water Associated Oil Co.) Substituted ammonium salts.
2,666,042 (Shell Development Co.) Process for preparing segmented copolymers.
2,666,046 (Standard Oil Development Co.) Copolymer manufacture.
2,666,076 (Standard Oil Development Co.) Preparation of aluminum alcoholate.
2,666,084 (Shell Development Co.) Production of primary halides.
2,666,687 (Union Oil Co. of California) Process for the manufacture of crystalline ammonium sulfite monohydrate.
2,666,690 (Food Machinery and Chemical Corp.) Process for the production of carbon disulfide by reacting hydrocarbons with sulfur.
2,666,735 (Standard Oil Development Co.) Purification of isopropyl alcohol of "mercaptan" odor.
2,666,736 (Celanese Corp. of America) Separation of n-propyl and sec.butyl alcohols by azeotropic distillation.
2,666,753 (Standard Oil Development Co.) Stabilization of vulcanized copolymers of isobutylene.
2,666,756 (Monsanto Chemical Co.) New catalytic process for the polymerization of ethylene.
2,666,765 (Universal Oil Products Co.) Production of alkenylthiophenes.
2,666,774 (Union Oil Co. of California) Polyhydroxy-ether addition compounds with metal salts.
2,666,779 (Anglo-Iranian Oil Co., Ltd.) Production of phosphorus esters from hydroperoxide.
2,666,780 (du Pont Co.) Hydrocyanation of olefinic compounds.
2,666,781 (Standard Oil Development Co.) Use of methylal to prevent emulsions in esters during the aqueous wash.

Fuels

2,664,340 (Eugene J. Houdry) Catalytic apparatus and method for treating auto exhaust gases.
2,664,388 (Socony-Vacuum Oil Co., Inc.) Hydrocarbon fuel oil of lowered pour point containing .05-7% of Smackover residual stock.
2,665,201 (Humphreys & Glasgow Ltd.) Manufac-

(To obtain more data on advertised products see page 424)

ture of carbureted water gas and in carburetors for use therein.
2,665,978 (California Research Corp.) Fuel oil composition containing N,N, di (alkyl aryl methylene)-N-alkylammonium alkane sulfonate sludge inhibitor.
2,665,979 (United Gas Improvement Co.) Cyclic method of reforming gaseous hydrocarbons for city gas.
2,666,021 (Cities Service Research and Development Co.) Stabilization cat cracked No. 2 fuel oil with Al fluoride catalyst.

Lubricants

2,663,690 (The Texas Co.) High-temperature sodium myristate grease containing N, N'diphenyl paraphenylene diamine.
2,663,691 (The Texas Co.) Grease containing diphenyl P-phenylene diamine and a phosphorus acid ester and method of making said grease.
2,664,202 (Standard Oil Co.-Ohio) Lubricant containing P-S. compound and polyolefin V-I improver.
2,664,399 (Mor-Film Co.) Dry coating and lubricating composition.
2,664,400 (Victor Chemical Works) Reaction products of an octyl acid pyrophosphate and soyamine and rust-inhibited lubricants containing the same.
2,664,436 (Standard Oil Development Co.) Lubricating oil composition of high viscosity and method for preparing same (polymer oxidized in presence of quinoline).
2,665,252 (Lubrizol Corp.) Lubricants containing wax-substituted diphenyl oxide sulfonic acid sulfide.
2,665,253 (Sun Oil Co.) Mineral oil containing 1,2-dialkoxy benzene as an oxidation inhibitor.
2,665,254 (Sun Oil Co.) Oxidation-inhibited mineral oil containing ether compound.
2,666,033 (The Texas Co.) Lithium soap grease containing methacrylate ester polymer for bearing noise suppression.
2,666,743 (Pure Oil Co.) Lubricating compositions containing aromatic sulfides.
2,666,744 (Califonia Research Corp.) Sulfurized grease compositions.
2,666,746 (Standard Oil Development Co.) Lubricating oil composition containing small amount of vinyl ester-dialkyl fumarate copolymer.
2,666,747 (Standard Oil Development Co.) Mineral oil composition containing copolymers of itaconic acid esters and a vinyl ester of a fatty acid.

Specialties

2,663,648 (Murray Jelling) Thermally stable bituminous bonding compositions.
2,663,672 (Standard Oil Development Co.) Production of asphalt by reacting with SiH_4.
2,665,206-7 (Shell Development Co.) Sizing of (cellulose) fibrous materials and compositions useful for sizing and for other purposes (cyclic extract with naphthenates).
2,665,234 (Phillips Petroleum Co.) Dibenzothiophenes as fungicides.
2,665,995 (Tide Water Associated Oil Co.) Rust-inhibiting composition containing hydrocarbon acid phosphate salt of alkylol amine esterfied with sulfonic acid.
2,666,000 (Standard Oil Development Co.) Process for cleaning automobile radiators with oxalate.
2,666,001 (Pure Oil Co.) Chemical method for removing residual sand from metal castings formed in sand-type molds, using acid.
2,666,009-10 (California Research Corp.) Quaternary ammonium germicide compositions.
2,666,523 (Standard Oil Development Co.) Packaging method using polyvinyl ether-isobutylene polymer.
2,666,708 (Universal Oil Products Co.) Maintaining stability of vegetable oils undergoing heating, using alkoxy phenol.
2,666,709 (Universal Oil Products Co.) Method for stabilization of edible oils and fats with tert butyl phenol ether.
2,666,745 (Standard Oil Development Co.) Corrosion-preventing agent containing hydrocarbon substituted cyanamide.

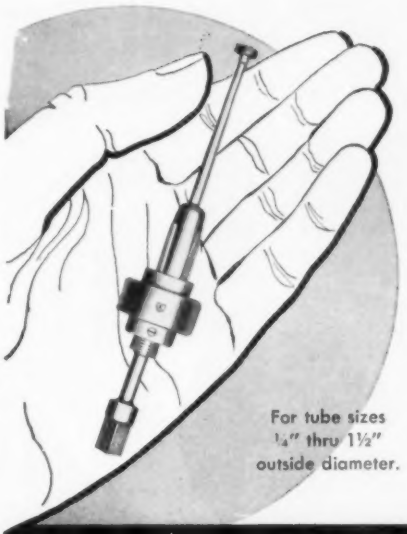
Miscellaneous

2,663,465 (Standard Oil Development Co.) Apparatus for metering finely divided solid materials.
2,663,593 (Houdry Process Corp.) Apparatus for pneumatic handling of granular material.
2,663,595 (Houdry Process Corp.) Elevating of granular solids.
2,663,597 (Phillips Petroleum Co.) Scaffolding device.
2,663,944 (Standard Oil Co.-Ohio) Piston rod stuffing-box gauge.
2,664,244 (Phillips Petroleum Co.) Air conditioning control apparatus.
2,664,245 (Lummus Co.) Pneumatic heater control.
2,664,431 (M. W. Kellogg Co.) Method for stabilizing soybean oil refined by solvent treatment.
2,664,744 (Atlantic Refining Co.) Holder for corrosion-testing coupons.
2,664,748 (Sun Oil Co.) Calibrated liquid storage gauge.

IDEAL

They Said it couldn't be made— but here it is!

No. 255 Precision-Built Tube Expanders



For tube sizes ¼" thru 1½" outside diameter.

These precision Ideal Tube Expanders are unequaled for rolling tubes in Condensers, Coolers and other heat-transfer units. The Ball Bearing, adjustable thrust collar reduces friction to a minimum. You get every desirable feature—plus—in No. 255.

See Your Dealer or Write Us Today!

THE GUSTAV WIEDEKE COMPANY
DAYTON 1, OHIO

DURA PLASTIC *Packings*

AN OUTSTANDING SEMI-METALLIC PACKING for stuffing box service on pumps, valves, mixers and the like handling gasoline—water —air—steam—oils—and chemicals.
PLIABLE . . . RESILIENT . . . UNIFORM IN DENSITY

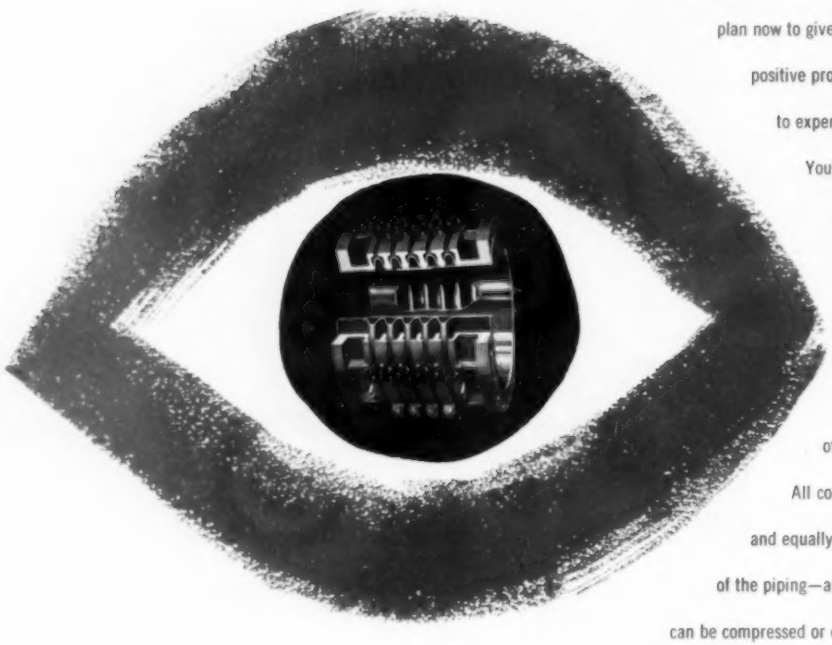
Write Today
For File DPPP, covering Durametallic and Duro Plastic Pack

The PERFECT SEAL

DURAMETALLIC CORPORATION
KALAMAZOO MICHIGAN

MANUFACTURERS OF METALLIC and SEMI-METALLIC PACKINGS
ROTARY MECHANICAL SEALS and PACKING TOOLS

(To obtain more data on advertised products see page 424)



If you've got your eye
on a profitable future,
plan now to give
positive protection
to expensive piping and equipment.
You'll avoid costly failure
due to expansion or contraction
by specifying Zallea
Duo-Equalizing Expansion Joints.
These joints are designed
to eliminate unequal distribution
of movement among the corrugations.
All corrugations move simultaneously
and equally during expansion or contraction
of the piping—and no corrugation
can be compressed or extended
more than the proportional amount
for which it is designed.

Zallea already has, or will make, expansion joints for every service. For information on standard types, request Bulletin 351. For consultation on special problems, ask us to have our representative call.

Zallea *expansion joints*

ZALLEA BROTHERS, 822 LOCUST STREET, WILMINGTON 99, DELAWARE

World's Largest Manufacturers of Expansion Joints

2,666,269 (U. S. A.) Method of drying solids in a fluidized bed.
2,666,448 (Phillips Petroleum Co.) Self-sealing relief valve.
2,666,583 (Phillips Petroleum Co.) Thermoresponsive color-change control device.

EQUIPMENT

Processing, general

2,663,465 (Standard Oil Development Co.) Apparatus for metering and controlling finely divided solid materials.
2,663,549 (Griscom Russell Co.) Spiral heat exchanger.
2,663,687 (Petrolite Corp.) Electric treater for emulsions.
2,664,190 (Phillips Petroleum Co.) Flow control apparatus.
2,664,274 (Lummus Co.) Method and apparatus employing sonic waves in heat exchange.
2,664,280 (Lummus Co.) Supporting beams for bubble trays.
2,664,346 (Hydrocarbon Research, Inc.) Fluid reactor.
2,664,348 (Phillips Petroleum Co.) High-pressure and temperature reaction chamber.
2,664,502 (Shepard Roberts) Ultrahigh-frequency mixer.
2,664,963 (Sivalls Tanks, Inc.) Gas and multiple liquid separator apparatus.
2,665,061 (Peter Steinacker and August Boyng) Countercurrent extraction centrifuge.
2,665,123 (C.D. Patents, Ltd.) Apparatus for treating gases with liquids.
2,665,196 (Dow Chemical Co.) Multistage internal mixer-settler extraction apparatus.
2,665,198 (Blaw-Knox Co.) Solvent extraction recovery method and apparatus.
2,665,769 (National Tank Co.) Method and apparatus for removing condensible fluids from gaseous streams.
2,665,974 (Andre Huet) Heat exchanger.
2,665,974 (Jefferson Lake Sulphur Co.) Apparatus for the recovery of elemental sulfur in liquid form from gases containing hydrogen sulfide.
2,665,975 (Standard Oil Development Co.) Apparatus for countercurrent contact of fluid materials.
2,666,528 (Universal Oil Products Co.) Treating chamber.
2,666,572 (Specialized Instruments Corp.) High-speed centrifuge apparatus.
2,666,625 (Westinghouse Electric Corp.) Heat exchange apparatus.
2,666,734 (Phillips Petroleum Co.) Apparatus for conversion of residual oils.
2,666,737 (Shell Development Co.) Fractionating column with removable trays.

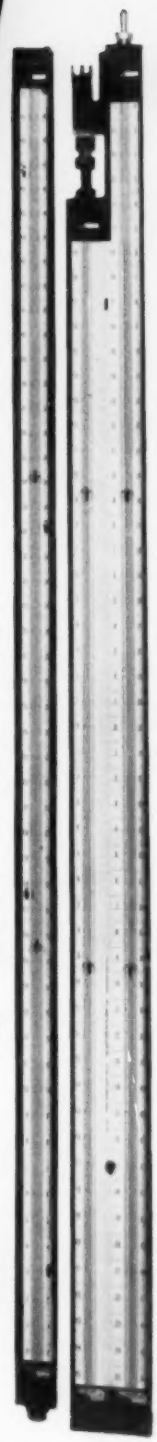
Catalytic reactors

2,663,593 (Houdry Process Corp.) Apparatus for handling granular material.
2,663,595 (Houdry Process Corp.) Apparatus for elevating granular material by a fluid-lifting medium.
2,664,338 (Gulf Oil Corp.) Line and valve system for fluidized particle handling.
2,664,347 (Phillips Petroleum Co.) Catalyst chamber collector system.
2,664,387 (Houdry Process Corp.) Process and apparatus for catalyst classification in a moving bed catalyst conversion process for hydrocarbons.
2,664,389 (Standard Oil Development Co.) Process and apparatus for the distillation of solids.
2,665,172 (Sun Oil Co.) Apparatus for pneumatically elevating contact material.
2,665,976 (Standard Oil Development Co.) Distributors in fluidized solids reactor vessels.
2,666,526 (Standard Oil Development Co.) Process and apparatus for separating mixed materials.
2,666,692 (Phillips Petroleum Co.) Catalytic reactor tube assembly.
2,666,731 (Socony-Vacuum Oil Co.) Method and apparatus for hydrocarbon conversion.

Instruments

2,664,183 (Western Inspection Co.) Apparatus for hydrostatically testing the pipe threads at an end of a tube.
2,663,186 (Felix Nieburg) Fuel distance meter.
2,663,188 (American Viscose Corp.) Liquid metering and flow-indicating device.
2,663,189 (Begwaco Meters Ltd.) Dry gas meter.
2,663,191 (Frederick M. Turnbull) Tank thermometer.
2,663,192 (August Segelhorst and Merrill Spurlock) Liquid-sampling device.
2,664,011 (Precision Thermometer and Instrument Co.) Liquid density-measuring equipment.
2,664,245 (Lummus Co.) Heater control.
2,664,246 (General Controls Co.) Automatic valve operating in response to temperature changes.
2,664,283 (Selas Corp. of America) Furnace control system.
2,664,511 (Patterson, Moos & Co.) A dosimeter for gamma radiation.
2,664,672 (Victor Ey) Gas pressure regulator.

Buying or Selling
...Rely on
MERIAM
MANOMETER
ACCURACY

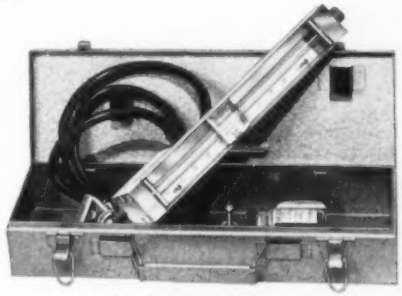


In custody transfer of valuable liquids or gases, greatest possible accuracy is required by both buyer and seller. Field measuring equipment must be precisely calibrated often. For this purpose Meriam Manometer Models B-2856 and B-2862 are extensively used.

The new, lightweight (twenty pounds) Meriam Model B-2856 Sectional U-Type Manometer in 100″ range using water offers the extreme accuracy and sensitivity required for calibration. All-aluminum construction, this model can be "broken" to 50″ length for carrying convenience. Interpolated readings to .025″water available.

The Meriam Model B-2862 Portable Field Manometer is the pioneer instrument for field calibration service. Designed with precision bore tubing, glass coated well, magnifier with anti-parallax device and a universal mounting bracket, this model in ranges up to 310″ water using mercury, offers a new high in utility and accuracy.

If you have a problem involving field calibration, drop us a line or call your Meriam Technical Representative. THE MERIAM INSTRUMENT COMPANY, 10989 Madison Avenue, Cleveland 2, Ohio.



Model B-2862 and Case

Model B-2856

MERIAM Instruments
ESTABLISHED 1911
MANOMETERS, METERS AND GAUGES FOR THE ACCURATE MEASUREMENT OF PRESSURES, VACUUMS AND FLOWS OF LIQUIDS AND GASES

(To obtain more data on advertised products see page 424)

ORONITE
LUBE OIL
ADDITIVES

Showing auto fitted with radio-activity gear to record instantaneous performance of oils compounded with Oronite additives. Tests are made under all types of driving conditions.

tested with radio-activity under field operating conditions

Oronite was first to make practical engine use of radio-activity to develop superior lubricating oil additives. This science has progressed far at Oronite in the past few years. Today, radio-activity is employed under all types of actual operating conditions to gain instantaneous measurements from oils compounded from Oronite additives—to provide you with even more advanced additives.

The research and testing facilities behind Oronite additives are the most advanced in the nation. With this years-ahead research it is possible that Oronite could provide your finished oil with competitive advantages you need to win and hold a market.

Oronite will tailor-make additives to your base oils—meeting your price and performance specifications.

See what Oronite additives can offer you. Just contact the Oronite office nearest you.

With Oronite Additives you can formulate oils to meet the new A.P.I. Service Classifications and can meet specifications for 2-104-B, MIL-O-2104, Supplement I and Series 2 oils.

OTHER ORONITE PRODUCTS

Gas Odorants
Polybutenes
Phenol
Wetting Agents
Dispersant FO
(Furnace Oil Inhibitor)

ORONITE CHEMICAL COMPANY
38 Sansome Street, San Francisco 4, California
30 Rockefeller Plaza, New York 20, New York
600 South Michigan Avenue, Chicago 5, Illinois
Standard Oil Building, Los Angeles 15, California
Mercantile Securities Building, Dallas 1, Texas

ORONITE CHEMICAL COMPANY

Patents

2,664,742 (Revere Corp. of America) Density-sensing instrument.
2,664,744 (Atlantic Refining Co.) Holder for corrosion-testing coupons.
2,664,747 (Davidson Chemical Corp.) Apparatus for indicating the level of a liquid-solids interface in a vessel.
2,664,748 (Sun Oil Co.) Apparatus for measuring liquid contents in a sealed pressure vessel.
2,664,749 (Barton Jones) Fluid pressure responsive equipment.
2,664,750 (Joseph J. McCrink) Pressure gage.
2,664,779 (John U. White) Flame analyzer and flame source.
2,664,907 (Proportioneers, Inc.) Apparatus for proportioning flows of different materials.
2,664,917 (Bristol Co.) Apparatus for measuring absolute pressure.
2,665,069 (Librascope, Inc.) Equation-solving mechanism.
2,665,197 (Ernest E. Rowland) Polymerization control apparatus.
2,665,332 (Sun Oil Co.) Magnetic measuring method and apparatus.
2,665,707 (Emory Frank Stover) Fluid pressure control apparatus.
2,666,090 (Karl W. Fitzpatrick) Thermocouple made of two alloys.
2,666,109 (Upjohn Co.) Liquid level control.
2,666,147 (U.S.A.) Radiant energy spectrometer.
2,666,569 (Westinghouse Air Brake Co.) Control apparatus for combined fluid compressors and free piston machines.
2,666,583 (Phillips Petroleum Co.) Thermoresponsive color change control device.
2,666,584 (Minneapolis-Honeywell Regulator Co.) Combustion control apparatus.
2,666,585 (Minneapolis-Honeywell Regulator Co.) Distance-adjusted pneumatic control system.
2,666,691 (Dow Chemical Co.) Recording titration apparatus.

Pumps & Compressors

2,663,262 (Jonkopings Mekaniska Werkstads Aktiebolag) Centrifugal pump with sealing device.
2,665,057 (Hellmuth Walter) Rotary blower.
2,665,640 (Bell & Gossett Co.) Centrifugal pump.
2,666,571 (Societe d'Inventions Aeronautiques et Mechaniques S.I.A.M.) A 3-stage position-type compressor.

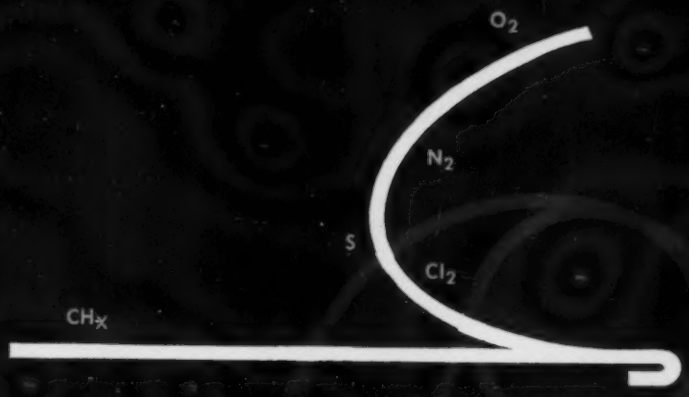
Valves & Fittings

2,664,107 (Ralph A. Spengler) Pilot-operated time-controlled gate valve.
2,664,111 (Sinclair Research Labs.) A control valve for regulating flow rates of fluids under micro conditions.
2,664,674 (Rockwell Mfg. Co.) Fluid flow regulator.
2,664,264 (Crane Co.) Check valve mounting.
2,664,267 (General Controls Co.) Hydraulically balanced gate valve structure.
2,664,914 (Benton Harbor Engineering Works, Inc.) Self-regulating flow-controlled valve.
2,664,915 (Minneapolis-Honeywell Regulator Co.) Interrelated automatic and manual valve control.
2,664,918 (Paul A. Dewhirst) Line blind construction.
2,665,105 (Crane Co.) Diaphragm sealed valve.
2,665,580 (Dwight Clawson) Valve leak detector.
2,665,711 (Asbury S. Parks) Fluid motor valve.
2,665,712 (Leo Pratt) Fluid pressure-actuated valve with stop means.
2,665,713 (Standard Oil Development Co.) Control valve.
2,665,874 (Edward Valves, Inc.) Bonnet and sealing structure for valves.
2,665,875 (Edward Valves, Inc.) Valve construction.
2,665,877 (Edward Valves, Inc.) Pressure sealed valve.
2,665,878 (Max Grunt) Ball valve.
2,666,448 (Phillips Petroleum Co.) Self-sealing pressure relief valve.
2,666,451 (General Controls Co.) Valve structure for controlling high-pressure fluids.
2,666,454 (Standard Oil Development Co.) Expansion joint.
2,666,614 (Grove Regulator Co.) Valve construction.
2,666,615 (W-K-M Co.) Gate valve.
2,666,616 (American Car Foundry Co.) Plug valve.
2,666,617 (Paul Valve Corp.) Ball valve.

How to Obtain Patents

Readers may obtain copies of any U.S. patent from the Patent Office at 25¢ each. Order by patent number direct from The Commissioner of Patents, Washington 25, D.C.

(To obtain more data on advertised products see page 424)



petrochemical processes

phenol
methanol
maleic and phthalic anhydride
ethylene oxide glycol ethanolamines
ammonia nitric acid ammonium nitrate urea

Foster Wheeler has been actively associated with both the petroleum and chemical industries for over 30 years and has designed and constructed many individual petrochemical process units as well as complete chemical plants.

FOSTER WHEELER CORPORATION

165 BROADWAY, NEW YORK 6, NEW YORK

FW

now "on stream"

the FOSTER WHEELER process for -

ammonia synthesis

TEXACO PARTIAL OXIDATION The new non-catalytic oxidation process for the low-cost conversion of hydrocarbons (gaseous or liquid) into Carbon Monoxide and Hydrogen. This process, now in commercial operation, represents the latest development in synthesis gas technology.

FOSTER WHEELER LIQUID NITROGEN WASH Design improvements in heat-exchange and liquid Nitrogen contact insure high-purity Hydrogen for subsequent Ammonia synthesis.

CASALE AMMONIA SYNTHESIS Featuring jet-recycling of unconverted feed, Casale, with over 40 plants operating throughout the world, is the lowest-cost synthesis process for the production of liquid anhydrous Ammonia.

Two Ammonia producing plants recently placed "on stream" and four more are in various stages of design and construction. These six plants have a rated capacity of **1000 Tons per day.**

Write for **Bulletin O-54-1**

FOSTER WHEELER CORPORATION

165 BROADWAY, NEW YORK 6, NEW YORK

EUGENE J. HOUDRY (left) is shown as he receives the John Scott medal award for scientific and technological achievement from Ernest T. Trigg, vice-president of the Board of City Trusts of Philadelphia. Joseph N. Pew, Jr. (center), chairman of the board of Sun Oil Co., looks on. The occasion was a recent meeting of the Board at the Engineer's Club in Philadelphia. Mr. Houdry is founder of the Houdry Process Corp., Philadelphia, and inventor of the catalytic cracking process bearing his name.

ASME Honors Thomas Lumly

Thomas M. Lumly, president of the Refinery Engineering Co., Tulsa, Okla., was given the 1953 Richards award "for outstanding achievement in mechanical engineering within 25 years after graduation." The honor was announced at the annual banquet of the American Society of Mechanical Engineers, held recently at the Statler Hotel, New York City.

Mr. Lumly graduated from Oklahoma A. & M. College in 1931 and gained experience in petroleum refinery construction and operation with companies in Texas, Kansas and Oklahoma. In 1938 he organized the Motor Fuels Corp. to build an oil refinery near Levelland, Texas, and a pipe line to the newly discovered Slaughter field. He sold his interest to become general manager of the National Oil Proprietary Ltd., of Sydney, an Australian government war agency.

After the United States entered World War II, Mr. Lumly returned and organized the Refinery Engineering Co. of Tulsa, which handled government contracts during the war. Since the war the company has expanded into five corporations operating in the United States and Canada.

Panellit Builds New Plant

As the first step in a major expansion and consolidation program, Panellit, Inc., maker of industrial control systems has begun construction on a new plant, in Skokie, Ill., just outside Chicago.

When completed, the 1-story plant situated on nine acres of ground will provide 82,000 sq. ft. of floor space and will house all engineering, manufacturing and administrative activities now being handled in seven locations.

Included in the consolidation are the two Panellit subsidiary companies, Panalarm Products, Inc., manufacturers of electrical alarm systems and panel-board accessories, and Panascan, Inc., makers of large-scale multiple information and control systems.

Black, Sivalls Promotes Two

Two recently opened southern Louisiana branches of Black, Sivalls & Bryson, Inc., fabricators of oilfield equipment, have been staffed with branch managers. Ray R. Noland, former serviceman at Houston, has been appointed manager of the new Harvey branch, and Louis Morgan, formerly at Lafayette, has been named manager of the Lake Charles branch.

B & W Adds Refractories Line

Under the terms of a new manufacturing agreement the Seaboard Refractories Co., Raritan Township, N.J., will devote its facilities to producing special refractories for the Babcock & Wilcox Co., New York. At the same time the Seaboard firm will discontinue its own sales activities and allow sales to be handled by Babcock & Wilcox.

All the products made by Seaboard will now be manufactured to Babcock & Wilcox's specifications, under their supervision, control and inspection procedures. The program is designed to expand and diversify the Babcock & Wilcox line of refractory products.

The refractories division of Babcock & Wilcox now manufactures and markets special refractories made of Kaolin and electrically fused mullite base materials. The Seaboard Co. specializes in custom-made shapes of silicon carbide, mullite-sillimanite, and fireclay base materials.

New Valve Repair Service

A new consultation service for on-the-line repair of high pressure valves has been instituted by the Universal Machine Co., Ambridge, Pa. The service operates as an adjunct to the firm's regular valve reconditioning activities, though all types and sizes of worn-out valves can be handled in the field.

Where conditions preclude on-the-line service the concern offers pick-up and delivery within 600 miles of Pittsburgh, Pa.

Rowand Given Newcomen Medal

William H. Rowand, vice-president of the Babcock & Wilcox Co., New York, was awarded the Newcomen Medal at a recent joint meeting of the Newcomen Society and the Franklin Institute in Philadelphia, Pa. The medal is given only once in three years, and Mr. Rowand is the third person in the history of the U. S. branch of the society to receive it.

Mr. Rowand

Foremost among Mr. Rowand's contributions to steam progress, which led to his nomination for the medal, was his invention in 1936 of the cyclone steam separator. This device effected a thorough separation of steam and water in boiler drums assuring

circulation of boiler water even at high pressures.

He was also active in the subsequent development of higher temperature and higher pressure boilers which this invention made possible.

Constructors Association Elects

John F. O'Connell, vice-president of the Bechtel Corp., San Francisco and New York, was elected president of the National Constructors Association at the association's annual meeting held recently in New York.

Mr. O'Connell

J. H. Sharpe, construction manager for Arthur G. McKee & Co., Cleveland, is the group's new vice-president.

Other members of the executive committee include E. R. McGonnigle, M. W. Kellogg Co., New York; C. C. Whittelsey, Ford, Bacon & Davis Construction Corp., Monroe, La.; T. C. Williams, Stone & Webster Engineering Corp., Boston; W. R. Wood, Girdler Co., Louisville, Ky.; L. C. Reynolds, C. F. Braun & Co., Alhambra, Calif.

Other chairmen elected for 1954, announced by the association were P. S. Klick, Jr., Foster Wheeler Corp., New York, chairman of the labor committee; B. O. Yeldell, Ford, Bacon & Davis Construction Corp., Boston, co-chairman; F. R. Stevens, Stone & Webster Engineering Corp., Boston, co-chairman; J. J. Kelly, M. W. Kellogg Co., New York, chairman of the safety committee; H. B. Christman, Fluor Corp. Ltd., Los Angeles, chairman of the foreign committee; and E. D. Hoekstra, H. K. Ferguson Co., Cleveland, chairman, public affairs committee.

Loven Chemical Plans Expansion

Loven Chemical of California, Inc., Newhall, manufacturers of phenolic resins and plasticizers, plans an expansion program featuring the construction of a phenol and formaldehyde plant having a yearly capacity of 10,000,000 lbs. of each substance.

X-Ray Diffraction School

The next session of the semi-annual X-ray diffraction school for registrants who find it convenient to visit New York City will be held at the plant of North American Philips Co., 750 S. Fulton Ave., Mt. Vernon, N.Y., during the week of April 19 to 23, 1954.

Basic subjects to be covered in the classroom sessions will include X-ray diffraction, diffractometry and spectrography. There will also be discussions on new high and low temperature camera techniques, electron microscopy and electron diffraction.

Monday through Thursday will be devoted to classroom and laboratory work, and Friday will be set aside for discussions of actual application problems, with guest speakers addressing the group on methods currently in use in research and industrial laboratories and plants.

Registration for the school will be limited to 125 for the first four days and to 150 for Friday. There is no registration fee, and because of the demand shown for the October school interested persons are advised to apply early.

Taylor Opens New Subsidiary

A subsidiary of the Taylor Instrument Cos. has been established in Australia so as to offer more of the company's services to customers in the sterling area. Facilities are being provided to afford sales, repair and manufacturing services.

W. E. Kirkby, sales manager of Taylor's English subsidiary, Short & Mason, Ltd., has been appointed managing director of the new company, known as Taylor Instrument Cos. of Australia Pty., Ltd.

Uhde Consultants Open Offices

The Uhde Corp., a new consulting firm in the field of chemical engineering, has opened offices in New York City, at Suite 8205, 350 Fifth Ave., In addition to direct collaboration with chemical companies, the firm will cooperate with design and construction companies for the purpose of erecting chemical plants in the organic and inorganic fields.

The services offered by the firm draw on the experience of Friedrich Uhde, G.m.b.H., of Dortmund, Germany, the design and construction unit of one of the leading groups of European chemical companies.

Activities of the Uhde Corp. are managed by F. B. Grosselfinger, executive vice-president.

Equipment Firm Opens Plant

Offices and a factory have been opened by Process Engineering & Machine Co. at 701 Spring St., Elizabeth 4, N. J. The company manufactures, under its trade mark, Pemco, and on either a designed or fabricated basis, process equipment such as condensers, columns, heat exchangers, mixers, and tanks.

Ten Join Southwest Institute

Ten scientists and technicians were added recently to the San Antonio staff of the Southwest Research Institute.

Entering the department of engines, fuels and lubricants research are S. J. Backey, who has been named manager of the environmental research section; George Coyle, a project engineer in the department; Walter K. Morris, project engineer; and James G. Pauly, also a project engineer.

The automotive research department has the services of Raymond Cappel, project engineer; Victor C. Kobold, project engineer; and Howard A. Langan, research engineer.

New men in the physics department are Raymond A. Garren, who was made senior electronics technician, and S. H. Simpson, Jr., named supervisor of the department's communications section.

Orin M. Anderson, the last of the ten, has been added as a research engineer in the department of engineering mechanics.

Boyd Koepke Joins UOP

Boyd F. Koepke, who has been associated with the petroleum industry for more than 30 years, joined Universal Oil Products Co. on the first of the year.

Mr. Koepke

Mr. Koepke has been engaged in technical sales work in the petroleum field for the Aluminum Co. of America for the past eight years. He will be Universal's sales representative to refiners and manufacturers of natural gasoline in the mid-continent and Gulf Coast areas.

He is a graduate of the University of Oklahoma, where he received the degree of Bachelor of Science in petroleum chemistry in 1921.

Other personnel promotions at Universal concerned three employees of the Riverside research and development laboratories. E. R. Kanhofer was named to the newly created post of general manager of manufacturing activities. H. W. Grote was promoted to assistant manager of the laboratories, replacing Mr. Kanhofer.

Dr. Julian M. Mavity, supervising research chemist, was appointed to

another post just created by the company—that of coordinator of service laboratories.

Colton to Make Microballoons

The Colton Chemical Co., Cleveland, Ohio, has been licensed by the Standard Oil Co. of Ohio to manufacture and sell "Microballoons." The company will also sell the small hollow plastic spheres under their trade name, "Cosmalite." The spheres ordinarily have been made of a phenolic resin, though a new type, made of urea formaldehyde resins, has been recently developed for production.

Personnel Changes

C. W. Nofsinger Co.—J. S. Rearick to manager of engineering, from the M. W. Kellogg Co., where he worked for over 16 years.

Panalarm Products, Inc.—Howard W. Hudson to vice-president in charge of engineering and production activities of this subsidiary of Panellit, Inc.

Girdler Co.—W. Doss Lumpkin to sales staff of the Votator Division. The company is a division of the National Cylinder Gas Co., Chicago.

Minneapolis - Honeywell Regulator Co.—Harold W. Sweatt to board chairman, from president, a post he has held since 1934.

Robertshaw-Fulton Controls Co.—Thomas G. Jeffers to the new position of assistant general manager of the Anaheim Division, Anaheim, Calif., and to assistant vice-president of the company.

Blaw-Knox Co.—Charles G. Strowe to sales engineer for the chemical plants division. He is located at the Pittsburgh office.

Nelson A. Howard Co. — Clark Graves to staff handling sales of chemicals and chemical additives to the petroleum refining industries.

Fluor Corp.—James P. Kneubuhl to vice-president of eastern area sales, from sales' manager of New York district; Harold T. Lorne to New York district sales' manager.

Kerotest Mfg. Co.—Russell H. Coe to sales' manager for steel valve sales, from sales representative in Pittsburgh, Pa.

These new Arnold O. Beckman bulletins describe...

WHERE OXYGEN CONTROL

is vital in a wide range of manufacturing and processing operations—chemicals, metals, soaps, oils, drugs, plastics, ceramics, petroleum products and many others.

WHY OXYGEN MEASUREMENT

is the key to more efficient operation, higher quality, better uniformity, less waste and greater overall profits.

HOW OXYGEN ANALYZERS

by Arnold O. Beckman, Inc. permit greater accuracy, adaptability, and efficiency than other types because these instruments *continuously* measure process streams by a unique magnetic principle that provides *direct physical measurement of oxygen itself*—not of some secondary relationship.

SEND TODAY FOR THIS HELPFUL DATA...

BULLETIN 103: *Describes the Model G-2 Beckman Oxygen Analyzer — the instrument to use where maximum accuracy is essential. Model G-2 ranges are available for oxygen concentrations as low as 0-1000 parts per million — as high as 95-100% — or virtually any other range or combination of ranges. Bulletin 103 describes the unique magnetic operating principle used in Model G-2 Analyzers, equipment, accessories and typical applications.*

BULLETIN 108: *Describes the Model F-3 Beckman Oxygen Analyzer —the instrument designed primarily for industrial applications such as combustion control, catalyst regeneration, sulfur grinding, etc., which require an oxygen measuring range of 0-5%, 0-10%, 0-15% or higher. Bulletin 108 describes the unique magnetic operating principle used in Model F-3 Analyzers, gives equipment specifications and typical applications for this instrument.*

BULLETIN AD607: *Contains helpful charts and data on most efficient methods of controlling various combustion processes.*

BULLETIN AD608: *Outlines savings to be made with oxygen control in Cat Cracking operations, gives sampling suggestions and list of equipment.*

BULLETIN AD612: *Describes gas monitoring system for gas plants and compressor stations, shows sampling arrangement, lists equipment required.*

BULLETIN AD701: *Describes a sampling system particularly suited for Cat Cracker applications . . . includes illustration of equipment layout.*

The above informative literature will gladly be sent you free. For maximum convenience, use the coupon at right.

Arnold O. Beckman INC

1020 Mission St., South Pasadena 17, California

Please send Bulletins checked below:

☐ 103 ☐ 108 ☐ 607 ☐ 608 ☐ 612 ☐ 701

Name _____

Company and Address _____

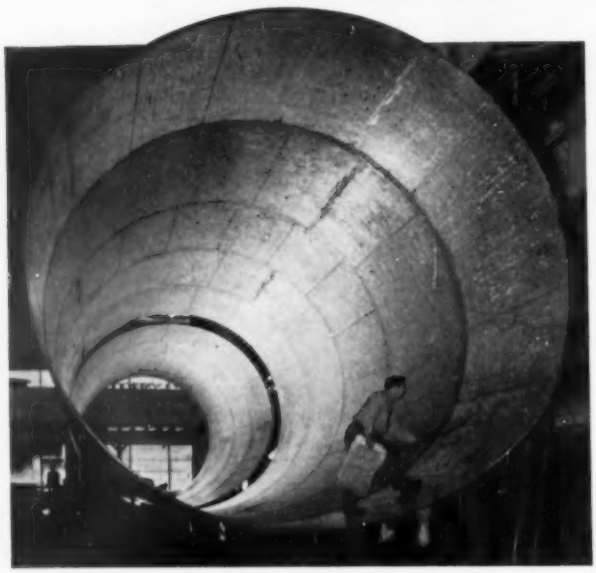
_____

_____

Position _____

(To obtain more data on advertised products see page 424)

When the Problem is HCl CORROSION ...look to MONEL for its Solution



IN DISTILLATION . . . Monel® has a high degree of corrosion resistance to the dilute HCl solutions formed in fractionation towers. It is used to line the upper portions of towers and for bubble caps and trays. Dephlegmators, condensers and condensate and reflux lines (and associate parts) are also frequently made of Monel. Monel clad or lined tops can be installed during tower fabrication, or linings can be made in existing equipment after repairs become necessary. Monel can easily be formed to vessel contours . . . is readily welded to itself and to the steel shell . . . large sheets can be used since the thermal coefficient of expansion of Monel approximates that of carbon steel.

IN ISOMERIZATION . . .

Monel is used where gaseous HCl and traces of water may combine to cause an unusually corrosive condition. It has found use in aluminum trichloride saturators, contactor separators, catalyst removal columns, vent gas scrubbers, hydrochloric acid stripper, catalyst strippers and reboilers for catalyst strippers.

IN CHLORINATED SOLVENT RECOVERY . . .

Processors find Monel outstanding for resisting dilute HCl corrosion. That's one of the main reasons Monel finds extensive use in distillation and condenser equipment. Other components of the systems, pipe valves, tubing, etc., are also frequently made of Monel.

IN ORGANIC CHLORINATIONS . . .

Chlorinators reaction vessels, coils and agitators are frequently made of Monel because of its high resistance to HCl corrosion. Monel's corrosion resistance also helps guard product purity.

IN PRODUCTION OF SYNTHETIC RESINS AND RUBBER . . .

Where HCl is used as catalyst or occurs as a result of hydrolysis, Monel is used for reactors, autoclaves, condensers and associated equipment such as valves, lines and fittings.

Monel is a superior structural material, too. It has high strength, good workability. Can be welded to form corrosion-resistant joints . . . can be machined, formed, bent . . . right on the job site.

Of course, there is no one metal, not even one Nickel Alloy, that can economically handle HCl corrosion problems under every operating condition.

That's why it's advisable to consult Inco's Corrosion Engineering Section. They have accumulated a vast amount of information that should help with a solution to your specific problems.

Just write, giving details . . . they will be glad to advise you. Address: The International Nickel Company, Inc., 67 Wall Street, New York 5, N. Y.

Inco Nickel Alloys

INCO TRADE MARK

Monel . . . *for minimum maintenance and replacement*

(To obtain more data on advertised products see page 424)

Mr. Boyer

Mr. Collins

Mr. Poorman

Mr. Tracy

Marion W. Boyer, vice-president of Esso Standard Oil Co., has been elected executive vice-president of the firm, replacing **Dr. Harry G. Burks, Jr.,** who has been named coordinator of Standard Oil of New Jersey's world-wide refining activities. Mr. Boyer has been associated with the company's manufacturing operations for 25 years.

To fill Mr. Boyer's position, **Edwin H. Collins,** formerly general manager of marketing, has been made a vice-president of the company. He has been a director and member of the executive committee since 1949.

Vacancies on Esso's board of directors were filled with the election of **Osgood V. Tracy,** general manager of chemical products, and **Glenn W. Poorman,** general manager of the supply department.

Mr. Tracy has for more than 20 years been engaged in the commercial development of chemicals from petroleum with the company. Mr. Poorman joined Esso Standard in 1932 and subsequently held posts in manufacturing, marketing, and supply and transportation operations, also as assistant to the president of Esso Standard.

George C. Montgomery has been appointed superintendent of Shell Oil Co.'s 64,000 b/d refinery at Wilmington, Calif., succeeding Stanley J. Meisenburg, who died October 30.

Mr. Montgomery joined Shell in 1926 at Wilmington, with a degree in chemistry from the University of Missouri. He worked as a technician there until 1935, when he was transferred to the Martinez, Calif., refinery. Later that year he returned as a department manager. In 1945, he was appointed assistant superintendent.

Mr. Meisenburg joined Shell in 1935 as a research chemist and moved to the head office as a senior technologist in 1938, after working at midwestern refineries. He became assistant superintendent of the Wood River refinery in 1944 and remained until 1947, when he was transferred to New York as assistant manager of the manufacturing-research and development department. In 1949, he was moved to Wilmington.

W. M. Weddell has been promoted from laboratory group leader to assistant director of the central research laboratory, a newly created post, of Dow Chemical Co.'s Texas Division, at Freeport.

J. J. Newport has replaced Mr. Weddell as laboratory group leader, and his former job, laboratory project leader in electrochemical engineering, has been assigned to **C. W. McCutchen,** formerly research and development engineer in electrochemical engineering.

Arnold C. Matthies and **Paul E. Kuhl** have resigned their positions with the Petroleum Administration for Defense and rejoined the Esso Standard Oil Co. Mr. Matthies joined PAD in February, 1953, and served as an assistant director of the refining and natural gasoline division. He is returning to Esso Standard's Baton Rouge, La., operations.

Mr. Kuhl began with PAD early in 1953 as director of foreign refining and was later named an assistant deputy administrator. He is returning to the Esso Standard organization as an assistant general manager of manufacturing.

A. H. Bransky has become senior patent attorney for Standard Oil Co. (Ind.) in the company's general office at Chicago. He did undergraduate work in chemistry at the University of Chicago and holds an L.L.B. degree from John Marshall Law School. Joining Standard Oil as a chemist in 1923, he became patent solicitor in 1936 and patent attorney in 1944.

Two other company promotions moved **Dr. R. C. Arnold** and **R. B. Terry,** Chicago office technologists, to the Whiting, Ind., laboratories as patent advisors. Dr. Arnold received his bachelor's, master's and doctor's degrees from Ohio State University and joined the company in 1948. Mr. Terry, a graduate of New York University, started with Standard Oil in 1943.

In a move to replace Dr. Arnold, **B. A. Vance,** a recent law graduate of Loyola University and an employee since 1949, was appointed technologist. **L. B. Stevens, Jr.,** a law graduate from John Marshall who was employed by the company in 1946, was transferred from the Whiting laboratories to Chicago as a patent searcher, replacing Mr. Vance.

M. L. Kalinowski, project chemist with degrees from the University of Chicago and the University of Illinois, has been appointed patent advisor at the Whiting laboratories, replacing Mr. Stevens. He has been with the company since 1948.

George T. Goggin has been appointed executive vice-president and treasurer of the Douglas Oil Co. of California, succeeding **James G. Stevens,** who has resigned the post to take the presidency of a Los Angeles firm which manufactures railway equipment.

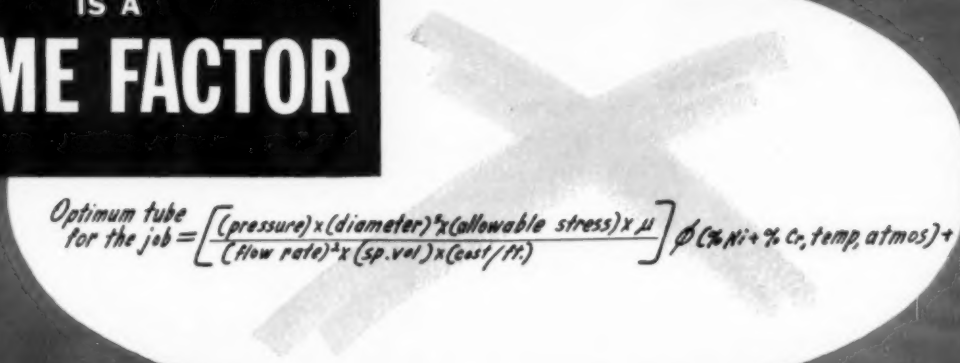
Mr. Goggin has been a director of the firm since it was organized in its present form in 1946, and has served as general counsel for five years. He is a graduate of the University of Washington and took his L.L.B. degree at Loyola University, Los Angeles.

L. P. Focte, formerly superintendent of the Markham, Texas, gas plant of the Ohio Oil Co., has been promoted to senior petroleum engineer, with headquarters at the company's general office in Findlay, Ohio. He is serving on the staff of the chief petroleum engineer, and his work includes the engineering phases of natural gas gathering lines and compressor installations, as well as the design, construction and processes of gasoline, cycling and other plants handling gas produced in the company's oil and gas field operations.

R. L. Luckhardt has been appointed manager of the technical service division of Brea Chemicals, Inc., a subsidiary of Union Oil of California.

Mr. Luckhardt's division has the task of developing new equipment and techniques for efficient, economical fertilization with aqua ammonia, the nitrogen fertilizer solution which will be mass-produced upon completion of

WHEN TEMPERATURE IS A PRIME FACTOR



Tube Selection Cannot Be Reduced to a Formula — Even a Complicated One

Many variables are involved in the selection of the optimum tubing for a specific high temperature application. If the tubing is also to operate under high stress, perhaps the most important variable to be considered is mechanical strength.

In general, the mechanical strength of a steel decreases as the temperature increases. Some steels, however, retain more of their strength at elevated temperatures than others. For instance, at 300F, the ultimate strength of both carbon steel and B&W Croloy 18-8 (Type 304) is about 70,000 psi. At 1200F, however, carbon steel is about 12,000 psi while Croloy 18-8 is about 44,000 psi.

To evaluate the characteristics of metals operating under stress at high temperatures and over long periods of time, B&W has performed stress rupture tests and creep tests on a great number of tubing steels.* The results of these tests help engineers to determine the proper tube to be used in specific applications.

Other factors beside mechanical strength, however, must be considered in choosing the optimum tubing for a specific high temperature application. Some of these factors are—oxidation resistance, tube size, tube cost, flow rates, and rates of conductivity and expansion.

It takes an expert to specify the right tubing for any particular application, and there is no substitute for the kind of experience with these problems you'll find at B&W.

To get the most benefit from B&W's long experience in matching tubes to jobs, call on Mr. Tubes, your nearby B&W Tube Representative. He can help you make the best choice.

Data shown in
TDC 102 Creep Stress Data on B&W Croloys
TDC 153 Stress Rupture Data on B&W Croloys available free on request.

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing

B&W SEAMLESS and WELDED TUBES

TA-4023 (P)

(To obtain more data on advertised products see page 424)

the Brea plant. The division will also provide technical information and service to dealers and their farmer-customers in the application of aqua ammonia and other agricultural chemicals.

Carl O. Tongberg has been appointed coordinator of research and development on products of the Standard Oil Development Co., research and engineering affiliate of Standard of New Jersey. Dr. Tongberg was previously director of the research division of another Jersey Standard affiliate, the Esso Laboratories, which are located at Linden, New Jersey.

Mr. Tongberg

Dr. Tongberg received his bachelor's and master's degrees in chemistry from Harvard University, and his doctorate in the same subject from Pennsylvania State College. He joined the Esso Laboratories in 1937.

Other appointments in the Standard Development firm have resulted in the promotion of **Charles L. Flemming, Jr.,** from associate director of the research division to director, and **John G. McNab,** from assistant director of the division to the post Mr. Flemming has relinquished.

Mr. Flemming

Mr. McNab

Dr. Flemming joined the Esso Laboratories in 1938, after receiving his bachelor's degree from Dartmouth College and his doctorate from the University of Illinois. He served as advisor to the Esso European Laboratories from 1947 to 1948, and has been on several scientific committees.

Dr. McNab received his B.A. and M.A. from Queens University, Canada, and his doctorate from the University of Chicago. Since 1936 he has been with Standard Development, and his work has been concerned largely with studies in the fields of fuels, lubricants and additives.

Alexis Voorhies, Jr., director of the Esso Laboratories, Baton Rouge, La., is the recipient of the Louisiana Engineering Society's technological achievement award for 1953. Mr. Voorhies was selected for the honor because of his work in the application of the fluidized technique for solids handling and in the problems and development of technical employees.

He is a graduate of Louisiana State University and of Loyola University in New Orleans. He worked for a time as a sugar engineer and later taught chemistry, physics and mathematics at a Louisiana college. Mr. Voorhies joined Esso Laboratories at Baton Rouge in 1930 as an engineer and subsequently served in various technical and supervisory positions. He was named director of the laboratories in 1947, after serving as associate director for a number of years.

Mr. Voorhies is a widely recognized authority in the engineering phase of petroleum refining processes. He is particularly well known for his work in the fields of hydrogenation, polymerization, fluid catalytic cracking, and fluid coking.

O. L. Lewis, of C. F. Braun & Co., Alhambra, Calif., was elected 1954 chairman of the petroleum division of the American Society of Mechanical Engineers during the group's recent annual meeting, held this year in New York City. He had an active part in the reorganization of the division in 1944 and has since served as publicity secretary, meetings' chairman, chairman of the refining committee, and secretary of the division.

Secretary of the division for 1954, also elected at the meeting, is **P. E. Frank,** Sinclair Oil Co., New York, who has served the body in the past as vice-chairman and chairman of the refining committee, and member of the executive committee. He is Sinclair's chief engineer in charge of all engineering and construction.

Other members of the executive committee are **M. A. Scheil,** A. O. Smith Corp., Milwaukee; **A. H. Newberg,** Service Pipe Line Co., Tulsa; and (new member) **J. S. Rearick,** M. W. Kellogg Co., New York.

J. P. Mooney, Humble Oil and Refining Co., Baytown, Texas, was elected chairman for 1954 of the refining committee, and **H. W. Evans,** Sinclair Oil and Gas Co., Tulsa, is its vice-chairman.

Buford D. Smith, Ph.D. in chemical engineering from the University of Michigan, and **Wayne E. Stevens,**

what's NEW in Engineering

A new concrete curing process, being tested by the New Jersey Highway Department, may speed the building of bridges and viaducts. It permits the wooden forms supporting wet concrete to be removed in 60 hours instead of the usual 14 days. After the concrete is poured into the forms, 3-foot square mats are laid on top and vacuum hoses are used to draw off excess water. This cures the concrete in a fraction of the time formerly required.

A sinking plant, and what to do about it, was one unusual assignment given Kaiser Engineers. A large area of land on which the tidewater plant was located had sunk six feet in twelve years; the dock loading area had become unusable at high tide. To solve the problem, Kaiser Engineers re-designed the dock area to increase its height and make it serve as a coffer dam to keep the water from affecting the round-the-clock operations of the mill. Tight construction scheduling was a must because of ship traffic and high tides.

Nuclear Engineering is the title of a new book, due this month, by Richard Stephenson, Consulting Chemical Engineer. This is the first book to bring together the many unique engineering problems encountered in the nuclear energy field.

Whatever your immediate research, design or engineering problems, however unusual they may be, an early consultation with Kaiser Engineers is an important step toward their quick, profitable solution. Call or write Kaiser Engineers Division of Henry J. Kaiser Company, Kaiser Building, Oakland 12, California.

(To obtain more data on advertised products see page 424)

PETROLEUM REFINERY ENGINEERING

A guidebook for plant managers, superintendents, chemists, engineers, and other refinery men concerned with efficient and economical petroleum refining. Covers in detail all major aspects of refinery engineering: testing petroleum products in relation to service performance; evaluating oil stocks; physical and chemical operations in processing; and the economics and calculation of equipment design. **By W. L. Nelson, Cons. Pet. and Chem. Engr.; Prof. of Pet. Ref., Univ. of Tulsa. 3rd Ed. 840 pp., 268 illus., 179 tables, $10.00**

NATURAL GAS and NATURAL GASOLINE

Explains **the production and transportation of natural gas** from crude-oil, condensate, and dry-gas fields, and the recovery, storage, and transportation of natural gasoline. Takes up the design and operation of modern gas gathering and natural gasoline recovery systems, improved methods in distillation and fractionation, gas dehydration, absorption, and the estimation of gas and gasoline reserves. Spotlights valuable engineering data on the location and design of natural-gas plants. **By R. L. Huntington, Prof. of Chem. Engr., Univ. of Okla. 598 pp., 287 illus., $8.00**

Elements of FRACTIONAL DISTILLATION

A unified coverage of the fundamentals from the standpoint of physical chemistry, viewing the design methods for determining the number of theoretical plates in fractional distillation apparatus and the mechanical problems encountered in fractionating column design and performance. Covers vapor-liquid equilibria, and all types of distillation—successive distillation, fractional condensation, rectification, etc. **By Clark Shove Robinson and Edwin Richard Gilliland, Prof. of Chem. Eng., MIT. 4th Ed. 492 pp., 175 illus., $7.50**

CHEMICAL ENGINEERS' HANDBOOK

Revised 3rd Edition

An outstanding handbook of chemical engineering standards and practice. Brings you almost 2,000 pages of definitions, descriptions, principles, methods, and data in every branch of chemical engineering. Includes material on general theory of diffusional operations, furnaces and kilns, size enlargement, azeotropic distillation, etc. **Prepared by a Staff of Specialists. John H. Perry, Editor, formerly Tech. Invest., E. I. Dupont de Nemours & Co. 1942 pages, 2057 illus., $17.00**

SEE THESE BOOKS TEN DAYS FREE

McGraw-Hill Book Co., 330 W. 42 St., NYC 36

Send me book(s) checked below for 10 days' examination on approval. In 10 days I will remit for book(s) I keep, plus few cents for delivery, and return unwanted book(s) postpaid. (We pay for delivery if you remit with this coupon—same return privilege.)

- ☐ Nelson—**Petroleum Refinery Engr.**—$10.00
- ☐ Huntington—**Natural Gas & Gasoline**—$8.00
- ☐ Robinson & Gilliland—**Elem. of Frac. Dist.**—$7.50
- ☐ Perry—**Chemical Engrs. Handbook** $17.00, payable $5.00 in 10 da., $4.00 a mo.

(Print)

Name .....

Address .....

City .....Zone....State.....

Company .....

Position PET-2

This offer applies in U. S. only

Ph.D. in chemical engineering from the University of Utah, have been added to the technical service division staff of the Humble Oil & Refining Co.'s Baytown, Texas, refinery.

Other staff additions made by Humble Oil concern the following: **J. J. Cunningham,** B.S. in civil engineering, Georgia Institute of Technology, and **J. T. Huffaker,** B.S. in civil engineering, University of Tennessee, both to the design department, engineering division; and **F. W. Lampe,** Ph.D. in chemistry, Columbia University, to the research and development division.

B. M. Downey, manager of Shell Chemical Corp.'s Houston, Texas, plant, has been appointed manager of manufacturing.

Mr. Downey

Mr. Fleer

Mr. Downey joined Shell in 1925 at Martinez as a laboratory helper and eventually assumed positions of responsibility with Shell Oil, Shell Development and Shell Chemical. In 1941 he was placed in charge of the Dominquez plant of Shell Chemical Corp., and in 1946 was transferred to Houston as manager of the plant there.

A. W. Fleer, manufacturing operations' manager, has been named manager of research, development and engineering. In this capacity he also has charge of the engineering, design and construction of new plant facilities for the company.

Mr. Fleer started his career with Shell in 1935 as a technologist at St. Louis. In 1944 he became technical assistant to the president of Shell Development Co. at San Francisco, Calif. He was appointed manager of manufacturing operations for Shell Chemical in 1952.

Raymond B. Bradstreet and **Ralph Miller** have joined the American Development Corp. to assist the firm's activities in the petroleum and allied fields.

Mr. Bradstreet, recently of Bradstreet Laboratories, Inc., for many years held technical positions with Standard Oil Development Co. and other Standard Oil affiliates. In his new position he is working as a technologist.

Mr. Miller had been director of research for the Chemical Foundation. He is the inventor or co-inventor of numerous processes, including the "Solexol" process for the solvent extraction of fatty oils and other materials. He will devote himself to research and development work in the petroleum and chemical fields in his new post with American Development.

H. M. Stewart has been appointed engineering associate in Humble Oil & Refining Co.'s Engineering Division, at Baytown, Texas.

Mr. Stewart received his bachelor's degree in electrical engineering at Texas A. & M. College in 1926, after which he was employed by Stone & Webster Engineering Co., in Brockton, Mass., for four years. He joined Humble's Engineering Division in 1930.

Dr. Arthur Philip Lien, research chemist of the Standard Oil Co. (Ind.), will receive the $1000 petroleum chemistry award of the Precision Scientific Co. at the March 27 meeting of the American Chemical Society.

A section leader in the Standard Oil Co.'s Whiting Research Laboratories, Whiting, Ind., Dr. Lien has done outstanding research work on the chemical conversion of certain less useful hydrocarbon components of petroleum into more useful materials, and on the chemical nature of the sulfur compounds in petroleum. His studies have resulted in the development of practical refining processes for separating complex mixtures of hydrocarbons and for removing sulfur compounds from petroleum.

Dr. Lien was born at Liberal, Kan., in 1914. He graduated magna cum laude from Ottawa University in 1937 and received the M.S. degree in 1939 and the Ph.D. in 1941 from Ohio State University. He joined Standard Oil Co. in that year.

Irvin E. Miller has been appointed superintendent of the laboratory at Standard Oil Co.'s (Ind.) Mandan, N.D., refinery, which is under construction. He has been succeeded as group leader at Standard's Sugar Creek, Mo., laboratory by **B. J. Duffy, Jr.**

Mr. Miller, a graduate of Kansas University, joined Standard Oil's research department at Sugar Creek in 1944 and was promoted to group leader in 1951.

Mr. Duffy holds bachelor and master's degrees from Massachusetts Insti-

tute of Technology, and joined the company as a chemical engineer at the Sugar Creek laboratory in 1948.

Curtis M. Klaerner has been appointed manager of the Buffalo, N. Y., refinery of the Socony-Vacuum Oil Co., replacing Richard B. Price, who has resigned to accept a position with Standard-Vacuum Oil Co.

Mr. Klaerner was, until this latest promotion, chief process engineer in the technical department of the Beaumont refinery of Magnolia Petroleum Co., a Socony-Vacuum affiliate.

He is a native of Fredericksburg, Texas, and graduated from the University of Texas in 1942 with a degree in chemical engineering.

Wilfred O. Taff and **Neil V. Hakala** have been appointed assistant directors in the Esso Laboratories of Standard Oil Development Co., Linden, N. J.

Mr. Taff

Mr. Hakala

Mr. Taff will handle research and development on new fuels processes in the laboratories' process division. He is a graduate of Western Kentucky State College and mastered in chemical engineering at the U. of Illinois. He has been with SOD since 1939.

Dr. Hakala, in the research division, will be responsible for research on automotive fuel quality and combustion problems. He graduated from Michigan College of Mining and Technology, received his doctorate from the U. of Wisconsin in 1943, and joined SOD soon after.

Adolph F. Spiehler, formerly assistant manager of Pure Oil Co.'s refinery technical department, has been appointed operations manager in the refining division.

Mr. Spiehler is a graduate and former instructor of the Massachusetts Institute of Technology. He joined Pure Oil in 1928 as a development engineer, and for 23 years has been in the company's headquarters in Chicago, working in the refinery process section. In his new post he will have direct charge of operations in all refineries.

Look...the New 40A

RIDGID

Tristand

with built-in folding tray

Tray pushes up easily to fold Tristand, pushes down easily to set up. Holds stand rigid.

Vise base overhangs front legs so threader handles swing clear. Perfect tripod and balance.

The Tristand you've been wanting. Now stand and tray all one unit—no loose parts. Extra-light weight, stronger more rigid than ever. Full size vise base—3 benders, ceiling brace screw, pipe rest, new tool-hanging slots. Designed for the utmost service for your money. See the new RIDGID 40 A Tristand at your Supply House! Immediate deliveries!

Folds up small as ever for easy carrying to job and it's extra lightweight.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U.S.A.

RIDGID

Work-Saver Pipe Tools

(To obtain more data on advertised products see page 424)

Years Ahead

BECKMAN RESEARCH INFRARED SPECTROPHOTOMETER

For those who require the utmost in accuracy and resolving power, the Beckman Model IR-3 is the unquestioned choice. Experience has shown conclusively that the IR-3 outperforms all commercial instruments with respect to resolving power, photometric accuracy, wavelength accuracy, freedom from stray light and elimination of background absorptions.

Single-beam double-monochromator. Design perfection achieves very nearly theoretical resolution. Stray light is absolutely undetectable at 15 microns even with the exceptional one-tenth of one percent measuring sensitivity of the Beckman IR-3.

Background absorptions eliminated. The entire optical path of the IR-3 can be evacuated to completely eliminate background absorptions from water vapor and carbon dioxide. Liquid and gas cell compartments in both entrance and exit beams are separately sealed so that cells can be changed without affecting the vacuum in the rest of the system. All optical elements and samples are held at a constant temperature by means of circulating water and thermostat-controlled bath.

True transmittance recording through Memory Standardization. No cell matching. Wavelength accuracy, 5 mμ; wavelength precision, 1 mμ.

Unexcelled resolution is illustrated by this NH_3 spectrum made with sodium chloride prisms.

Select an instrument today that will do tomorrow's jobs. See your Beckman Field Representative about the superlative IR-3 or write for Data File 93-23

Beckman *division*

BECKMAN INSTRUMENTS, INC.
SOUTH PASADENA 1, CALIFORNIA

Big Program Set for API Refiners

AN extensive program of wide general interest to the petroleum processing industries has been arranged for the 19th midyear meeting of the American Petroleum Institute's Division of Refining in Houston, Texas, May 10-13.

A total of 53 papers and one panel discussion, covering 10 different subjects during 12 sessions, comprise the complete four-day program.

Topics to be covered include petrochemicals, processes, fractionation, waste disposal, motor fuels, tank failures, maintenance, training, corrosion, and analytical research. A full day will be devoted to problems of refinery maintenance, including a panel discussion on planning for major unit turnarounds. A full session will be centered on the preignition problem, gasoline additives, etc.

Results of the survey by the Study Group on "Oil Storage Tank Failures" will be reported during the Tuesday evening session on tank failures. Both water and atmospheric pollution problems are scheduled for coverage in the Wednesday morning session on waste disposal. Analytical research will receive its usual strong attention, with 16 papers planned for two sessions on Monday.

A tentative program follows:

Monday, May 10, 9:00 a.m.
ANALYTICAL RESEARCH

Presiding: C. E. Headington, The Atlantic Refining Co., Philadelphia, Pa.

"Operation of a Petroleum Research Analytical Laboratory," W. C. Schaefermeyer and E. S. Smith, Union Oil Co. of California, Brea, Calif.

"Determination of Mercaptans by an Amperometric Method," M. D. Grimes, J. E. Puckett, and B. J. Newby, Phillips Petroleum Co., Bartlesville, Okla.

"High Efficiency Laboratory Fractionating Equipment," J. C. Winter and R. A. Dinerstein, Standard Oil Co. (Ind.), Whiting, Ind.

"New Techniques for Analyzing Mixtures of Trace Metals," R. M. Sherwood and F. W. Chapman, Atlantic Refining Co., Philadelphia, Pa.

"A Hydrogen Sulfide Analyzer-Recorder," E. B. Offutt and L. V. Sorg, Standard Oil Co. (Ind.), Whiting, Ind.

"Micro Distillation Methods for Analysis of Petroleum," A. R. Jave, C. Liddell, and W. H. Thomas, Anglo-Iranian Oil Co., Ltd., Sunbury-on-Thames, Middlesex, England.

"A Reduced Scale Reid Vapor Pressure Apparatus," R. L. LeTourneau, J. F. Johnson, and W. H. Ellis, California Research Corp., Richmond, Calif.

"Determination of Water in Acetaldehyde by Infrared Spectroscopy," J. A. Favre and J. B. Butler, Phillips Petroleum Co., Bartlesville, Okla.

CORROSION

"Corrosion and Prevention — Heat Exchangers in Cooling Water Service," J. D. Munro, Standard Oil Development Co., Linden, N. J.

"Selection of Paints and Application in Combatting Atmospheric Corrosion," F. T. Radecke, Shell Oil Co., Wood River, Ill.

"Hydrogen Chloride Evolution from Crude Oils as a Function of Salt Concentration," G. J. Samuelson, Petrolite Corp., St. Louis, Mo.

Monday, May 10, Afternoon
ANALYTICAL RESEARCH

Presiding: R. J. Askevold, The Pure Oil Co., Crystal Lake, Ill.

"Tetraethyl Lead in Gasoline—A Review of Analytical Methods," C. M. Gambrill and Sue A. Gendernalik, Ethyl Corp., Detroit, Mich.

"Rapid Colorimetric Method for Phenyl alpha Naphtyl Amine in New and Used Oils," W. S. Levine, Socony-Vacuum Laboratories, Brooklyn, N. Y.

"Spectrochemical Determination of Copper in Crankcase Drainings," J. Hansen and C. R. Hodgkins, Standard Oil Development Co., Linden, N. J.

"Determination of Trace Amounts of Iron, Nickel and Vanadium on Catalysts by X-Ray Fluorescence," G. V. Dyroff and P. Skiba, Standard Oil Development Co., Linden, N. J.

"Non-Metal Analysis of Micro Quantities of Solids by Means of the Emission Spectrum," E. L. Gunn, Humble Oil & Refining Co., Baytown, Tex.

"Spectrographic Methods for Analyzing Lubricating Greases," C. W. Key and G. D. Hogan, Richfield Oil Corp., Wilmington, Calif.

"Spectrographic Analysis of Petroleum Products and Related Material," L. L. Gent, C. P. Miller, and R. C. Pomatti, The Texas Co., Beacon, N. Y.

"Application of the Logarithmic Sector to Semi-Quantitative Spectrographic Analysis of Petroleum Ash Residues," E. B. Childs and J. A. Kanehann, Socony-Vacuum Laboratories, Brooklyn, N. Y.

TRAINING

Presiding: G. R. Bryant, The Texas Co., Houston, Tex.

"Basic Management Training for Hourly Employees," W. E. Bennett, Cities Service Refining Corp., Lake Charles, La.

"How to Train Your Subordinates," Richard E. Crow, Continental Oil Co., Houston, Tex.

A paper, title to be announced — L. R. Boulware, General Electric Corp., New York, N. Y.

Tuesday, May 11, Morning
REFINERY MAINTENANCE

Presiding: Bonner Barnes, Gulf Oil Corp., Pittsburgh, Pa.

"Minimizing the Refinery Maintenance Crew," F. C. King, General Petroleum Corp., Los Angeles, Calif.

"The Use of Technically Trained Men in Refinery Maintenance Work," D. G. Debo and J. G. Houseman, Standard Oil Co. (Indiana) Whiting, Ind.

"A Correlation of Manpower Requirements, Maintenance Requirements, and Equipment Selection," J. S. Dalton and M. A. Pappas, Standard Oil Co. (Ohio) Cleveland, Ohio.

"Effective Control of Storehouse Operations," J. H. Anderson, Humble Oil & Refining Co., Houston, Tex.

Tuesday, May 11, Afternoon
REFINERY MAINTENANCE

Presiding: Clarence Thayer, Sun Oil Co., Philadelphia, Pa.

"Area Supervisor System as Applied to Baton Rouge Refinery," O. R. Minton, Esso Standard Oil Co., Baton Rouge, La.

Panel Session — "Planning for Major Unit Turnarounds," C. H. Trotter, Phillips Petroleum Co., Bartlesville, Okla.; E. C. Newton, The Atlantic Refining Co., Philadelphia, Pa.; J. T. Tippit, The Texas Co., Port Arthur, Tex.; A. C. Collins, Shell Oil Co., Wood River, Ill.

Tuesday, May 11, Evening
OIL STORAGE TANK FAILURES

Presiding: R. G. Sanders, Magnolia Petroleum Co., Beaumont, Tex.

"Brittle Failure of Steel Structures—A General Engineering Problem," Prof. M. E. Shank, Massachusetts Institute of Technology, Cambridge, Mass.

"Results of the Survey of Study Group

Oil Man's Calendar

MARCH

National Ass'n of Corrosion Engineers, 10th annual conference and exhibition, Kansas City Municipal Auditorium, Kansas City, Mo., March 15-19.

American Chemical Society, 125th national meeting, Municipal Auditorium, Kansas City, Mo., March 24-April 1.

Western Petroleum Refiners Ass'n, annual meeting, Plaza Hotel, San Antonio, Texas, March 29-31.

APRIL

American Society of Lubrication Engineers Netherland-Plaza, Cincinnati, Ohio, April 5-7.

Instrument Society of America, New Jersey Section, sixth annual symposium on "Flow and Its Measurements," Hotel Essex House, Newark, N. J., April 6.

National Petroleum Ass'n, 51st semi-annual meeting, Cleveland Hotel, Cleveland, Ohio, April 14-16.

Fourth John Zink Process Heating Seminar, John Zink Burner Co., 4401 S. Peoria, Tulsa, Okla., April 17.

Natural Gasoline Ass'n of America, 33rd annual convention, Baker Hotel, Dallas, Texas, April 21-23.

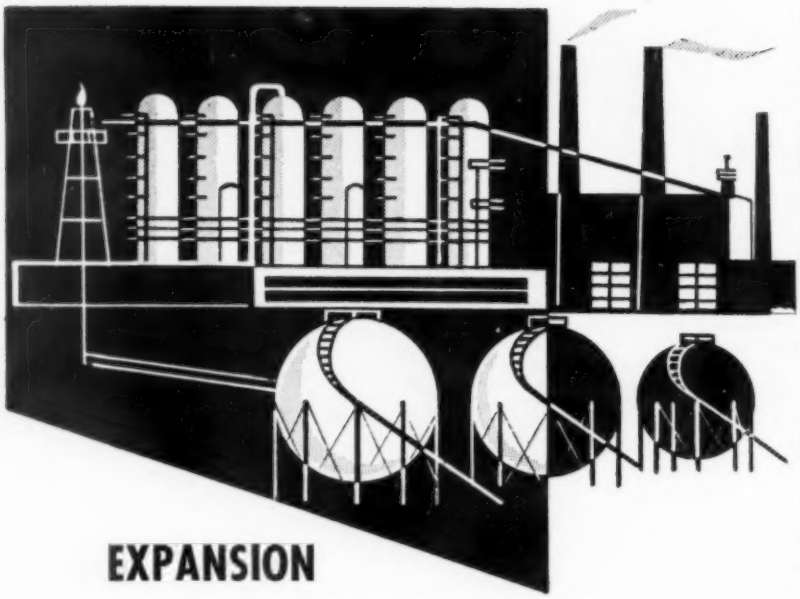
Ass'n of Consulting Chemists and Chemical Engineers, symposium and banquet, Hotel Belmont Plaza, New York, April 27.

MAY

Liquefied Petroleum Gas Ass'n, annual convention, Conrad Hilton Hotel, Chicago, Ill., May 9-12.

American Petroleum Institute, Division of Refining, 19th mid-year meeting, Rice Hotel, Houston, Texas, May 10-13.

2nd Basic Materials Exposition and Conference, International Amphitheatre, Chicago, Ill., May 17-20.



EXPANSION

MODERNIZATION

NEW FACILITIES

KULJIAN OFFERS THESE SERVICES:

STEAM GENERATION & UTILIZATION
ELECTRICAL GENERATION & DISTRIBUTION
FUEL STORAGE SYSTEMS & PIPING
PROCESS SYSTEMS & INSTRUMENTATION
REFINERY FACILITIES IN GENERAL

ENGINEERING—Preliminary studies and designs followed by detailed working drawings and specifications. (Services of resident engineer are optional.)

CONSTRUCTION—Project management, including coordination of sub-contractors and field forces. (Accounting and purchasing services are optional.)

ENGINEERING AND CONSTRUCTION—Undivided responsibility, from preliminary studies to completed construction.

The Kuljian Corporation

ENGINEERS • CONSTRUCTORS

1200 North Broad Street, Philadelphia 21, Pa.

MEXICO CITY • CARACAS • MADRID • ROME • BAGDAD • FRANKFURT • ATHENS • TOKYO • CALCUTTA

on Oil Storage Tank Failures," by members of the Study Group.

"Some Economic Aspects of the Oil Storage Tank Failure Problem," F. A. Gitzendanner, Standard Oil Co. (Ind.) Whiting, Ind.

"The Standard Oil Development Company Study of Brittle Failure of Tank Steels," F. J. Feely, Jr., and M. S. Northup, Standard Oil Development Co., Linden, N. J.

Wednesday, May 12, 9:30 a.m.

MOTOR FUELS

Presiding: Bruce K. Brown, Pan-Am Southern Corp., New Orleans, La.

"The Contribution of Surface Combustion of the Fuel to Preignition," R. E. Wilson, H. W. Bowditch, G. J. Nebel, General Motors Research, Detroit, Mich.

"The Preignition Resistance of Fuels," B. M. Sturgis, E. N. Cantwel, W. E. Morris and D. L. Schultz, DuPont, Wilmington, Del.

"The Selection of Fuel Additives to Reduce Preignition," F. C. Burk, L. J. Test, and H. R. Jackson, Atlantic Refining Co., Philadelphia, Pa.

"The Measurement and Chemical Control of Preignition in Engines," J. S. Wintringham, J. B. Hincamp, and H. A. Toulmin, The Ethyl Corp., Detroit, Mich.

WASTE DISPOSAL

Presiding: C. C. Tate, Phillips Petroleum Co., Bartlesville, Okla.

"Chemical Flocculation of Refinery Wastes," R. F. Weston, Atlantic Refining Co., Philadelphia, Pa.

"Planning and Execution of an Oil Refinery Waste Survey," A. P. Dennis, Jr., Bayway Refinery, Esso Standard Oil Co., Bayway, N. J.

"New Oil Reclamation and Waste Disposal Facilities," J. F. O'Reilly, Skelly Oil Co., El Dorado, Kan.

"Preferential Withdrawal of Catalyst Fines to Reduce FCC Stack Losses," D. L. Cleveland, Shell Oil Co., Wilmington, Calif.

"Catalytic Combustion of Refinery Waste Gases," David B. Ardern, Houdry Process Corp., Philadelphia, Pa.

"Status Report on Research Program of the Smoke and Fumes Committee," Vance N. Jenkins, Union Oil Co. of California, Los Angeles, Calif.

Wednesday, May 12, Afternoon

PETROCHEMICALS

Presiding: C. W. Humphreys, Shell Chemical Corp., New York.

"Petrochemicals—Glamour Girl or Problem Child?" G. B. Ryan, H. K. Nieuwenhuis (Consultant) and V. A. Brietenbach, Standard Oil Co. (Ohio), Cleveland, Ohio.

"Isobutylene Manufacture Using Sulfuric Acid Process," G. P. Baumann, M. R. Smith, Standard Oil Development Co., Linden, N. J.

"Simultaneous Extraction of Benzene and Toluene by the SO_2 Process," Kolar and Strobel, Continental Oil Co.

A fourth paper on Ethylene manufacture will be given.

Wednesday, May 12, Evening

OPEN DINNER SESSION

Presiding: John W. Newton, Vice President for Refining (American Petroleum Institute) Magnolia Petroleum Co., Beaumont, Tex.

Opening Remarks: John W. Newton.

Open Dinner Address: Dr. Robert F.

Pearce, Worthington Associates; address will be on the subject of recognition of executive ability in others and yourself.

Thursday, May 13, Morning
PROCESSES

Presiding: H. Dayton Wilde, Humble Oil & Refining Co.

"Dualayer Refining of Distillate Fuel Oils," C. A. Duval, R. T. Malin, and V. A. Kalichevsky, Magnolia Petroleum Co., Beaumont, Tex.

"Hyperforming," Clyde Berg, Union Oil Co., Wilmington, Calif.

"Model II Fluid Hydroformer and Its Application," E. W. Nicholson, Esso Standard Oil Co., Baton Rouge, La.

"Factors in Selecting a Catalytic Reforming Process," J. A. Bock, W. R. Hertwig, L. W. Russum, and R. A. Steel, Standard Oil Co. (Indiana), Whiting, Ind.

Thursday, May 13, Afternoon
FRACTIONATION

Presiding: C. P. Baker, Socony-Vacuum Oil Co., New York, N. Y.

"Fractionation Equipment Sizes for Refinery Feed Stocks," G. T. Atkins and G. W. Wilson, Humble Oil & Refining Co., Houston, Tex.

"Behaviour of Binary and Ternary Mixtures During Continuous Distillation," M. R. Fenske, Pennsylvania State College, State College, Pa.; and Norman Kirk, General Electric Corp., Schenectady, N. Y.

"The Performance of Catalytic Units Fractionating Towers," G. S. Houghland, E. J. Lemieux, and W. C. Schriener, The M. W. Kellogg Co., Jersey City, N. J.

"Hydraulics of Tray Design," Prof. R. L. Huntington, University of Oklahoma, Norman, Okla.

John Zink Co. To Hold Fourth Heating Seminar

THE Fourth John Zink Process Heating Seminar, scheduled for Saturday, April 17, at the John Zink Burner Co., Tulsa, will cover four important subjects: refractories, water treatment, fuel oil additives, and equipment inspection.

Attendance totaling more than 300 engineers from the petroleum and chemical processing industries is expected. Although attendance is by invitation, John Zink states invitations will be sent to all who request them.

Papers to be presented at this meeting at the company's main office, 4401 South Peoria, Tulsa, Okla., include the following titles:

"High Temperature-High Thermal Conductivity Refractories," The Carborundum Co.

"Ion-Exchange Treatment of Process Water," National Aluminate Co.

"Fuel Oil Additives to Avoid Fouling of Heat Transfer Surfaces," The Babcock & Wilcox Co.

"Radiographic Inspection of Process Equipment plus Quick Analytical Means for Determination of the Cause of Catalyst Poisoning," The Arthur C. Sweeny, Jr. Co.

Where corrosion...temperature...pressure cause other valves to fail . . .

THEY'RE "STICK-PROOF"

Operate Instantly...Everytime...Anytime

For more than 20 years, in practically every type of industry, HOMESTEAD LEVER-SEALDS have been giving trouble-free performance in services where extremes of temperature or pressure or corrosive line fluids cause ordinary valves to "stick" or "seize."

HOMESTEAD Lever-Seald PLUG VALVES are "Stick-Proof" because they're "Lever-Seald," which means that a powerful lever-and-screw device, built into every valve, assures positive action at all times under all conditions.

They operate fast, too—full open or closed by a quarter-turn; and because all operating parts are protected from line fluids, service conditions and weather, they last longer and cost less to maintain.

We make them in metals and alloys to suit your requirements in sizes 1½" to 12", for pressures from vacuum to 1500 lbs. and for temperatures ranging from 40° below zero to 1100° F.

note these exclusive HOMESTEAD features

- Instant Stick-Proof operation.
- Quarter-turn fully opens or closes.
- Positive seal without lubrication.
- Seating surfaces always protected in both open and closed positions. Corrosion practically eliminated.
- Unobstructed straight-line fluid flow.
- All operating parts protected from damaging effects of service conditions and weather.

For Complete details and prices, write today for your copy of VALVE REFERENCE BOOK No. 39-3. No obligation.

HOMESTEAD VALVE MANUFACTURING COMPANY
"Serving Since 1892"
P. O. Box 43 Coraopolis, Pa.

(To obtain more data on advertised products see page 424)

PALMER
MERCURY ACTUATED

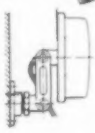
DIAL THERMOMETERS

in 3 types to suit any requirements

PATENTED

Full 4½" dial face. Stem can be placed at any angle and case can be rotated to any readable position.

1 **Rigid Stem Dial Thermometer** tapered bulb, interchangeable with standard industrial thermometer separable socket. (As illustrated above.)



2 **Wall Mounted Dial Thermometer** with flexible connecting armor. Case adjustable to easy reading position.

3 **Flush Mounted Dial Thermometer** for panel mounting with flexible connecting armor.

All three types have a full 4½" dial face.

for accuracy: Mercury actuated . . . Fully Compensated by Invar Compensaton. Guaranteed Accurate 1 scale division.

for angularity: Can be adjusted to most readable position at any angle desired.

for readability: Bold Black Numbers . . . 11" of scale Reading Dial face can always be placed in easiest readable position.

for interchangeability: Always specify "PALMER" Separable sockets as they are interchangeable for Dial or Industrial type Thermometers.

Send for Bulletin 51-129 for details on the New Palmer Dial Thermometer.

PALMER
THERMOMETERS, INC.
Norwood Ave., Cincinnati 12, Ohio
Mfrs. of Industrial Laboratory Recording and Dial Thermometers

Information Offered in the Advertisements

Do you need detailed information on a specific subject? Check through this easy-to-use index of literature and data being offered in this issue's advertisements.

ADDITIVE, fuel oil, No. 2; samples and descriptive booklet; Du Pont Co., Petroleum Chemicals Division, 1270 Avenue of the Americas, New York City. See adv't. p. 400.

CATALYST, for reforming; brochure, "Catforming"; Atlantic Refining Co., P.O. Box 8138, Philadelphia, Pa. See adv't. p. 308.

CATALYST CARRIERS, made of "Alundum"; Sales Engineering Bulletin No. 7; Norton Co., 262 New Bond St., Worcester 6, Mass. See adv't. p. 402.

CAUSTIC SODA; Bulletin 100 describes company's products and services; Hooker Electrochemical Co., 15 Forty-seventh St., Niagara Falls, N.Y. See adv't. p. 345.

CONDUIT, electrical, rigid, aluminum; booklet available, "Alcoa Aluminum Electrical Rigid Conduit"; Aluminum Co. of America, 2093-C Alcoa Bldg., Pittsburgh 19, Pa. See adv't. p. 321.

COOLING TOWER installations; bulletin, "Cooling Water for Industry"; Fluor Corp., Ltd., Los Angeles 22, Calif. See adv't. p. 320.

EXPANSION JOINTS, equalizing; information on standard types; Bulletin 351; Zallea Bros., 822 Locust St., Wilmington 99, Del. See adv't. p. 406.

FABRICATIONS, clad steel; movie, "Equip for New Profits"; Lukens Steel Co., 682 Lukens Bldg., Coatesville, Pa. See adv't. p. 335.

FABRICATORS, specialists in corrosion control; Bulletin 902-R-1 and Buyer's Guide; The Pfaudler Co., Rochester 3, N.Y. See adv't. p. 380.

FITTINGS, complete manifolding installation; Catalog 53-C, Chiksan Co., Brea, Calif. See adv't. p. 334.

FITTINGS, valves, seals, spindles; new catalog; Hoke, Inc., 161 S. Dean St., Englewood, N.J. See adv't. p. 394.

FLOW TRANSMITTER, differential; Bulletin No. 98226 about company's 3-part "Transet" system; Taylor Instrument Cos., Rochester, N.Y., and Toronto, Can. See adv't. p. 342.

FRACTIONATION, caps and risers; Catalog 52; Pressed Steel Co., Wilkes-Barre, Pa. See adv't. p. 328.

HYDROGEN-CARBON RATIO measurement with beta rays; Cenco Ray H/C Meter; Bulletin 115; Central Scientific Co., 1700 Irving Park Rd., Chicago 13. See adv't. p. 338.

LEAD products, corrosion resistant; booklet, "Chemical Lead Products"; National Lead Co., New York 6, N.Y. See adv't. p. 399.

PACKINGS, Teflon, chemical resistant; Bulletin TP 1053; United States Gasket Co., Camden 1, N.J. See adv't. p. 432.

PACKINGS, semi-metallic; File DPOE covers Durametallic and Dura Plastic types; Durametallic Corp., Kalamazoo, Mich. See adv't. p. 405

PUMPS, external gear and bearing; Bulletin G-2; Sier-Bath Gear and Pump Co., 9261 Hudson Blvd., North Bergen, N.J. See adv't. p. 442.

RECORDER, circular; catalog available; Electric Auto-Lite Co.; Toledo 1, Ohio. See adv't. p. 438.

SEAL, mechanical, made of Teflon; booklet describing Type 9 shaft seal available; Crane Packing Co., 1832 Cuyler Ave., Chicago 13, Ill. See adv't. p. 398.

SPECTROPHOTOMETER, infrared, Model IR-3; Data File 93; Beckman Instruments, Inc., South Pasadena 1, Calif. See adv't. p. 418.

STEAM TRAP, with stainless steel valve; Bulletin T-1740, Yarnall-Waring Co., 137 Mermaid Ave., Philadelphia 18, Pa. See adv't. p. 314.

TURBINES, mechanical-drive, single oil cooler; Bulletin GEA-4955A, "A New Standard in Mechanical-drive Turbines"; General Electric Co., Schenectady 5, N.Y. See adv't. p. 340-341.

VALVES, cast, forged, stainless steel; Catalog Digest available; Ohio Injector Co., Wadsworth, Ohio. See adv't. p. 336-337.

VALVES, plug, lever; "Valve Reference Book" No. 39-3; Homestead Valve Mfg. Co., Coraopolis, Pa. See adv't. p. 421.

VALVES, triple-action, cast steel; Bulletin GV-3; Greenwood Valve Division, Vernon Tool Co., Ltd., 1099 Meridian Ave., Alhambra, Calif. See adv't. p. 434.

(To obtain more data on advertised products see page 424)

POLYRAD CONTROLS ACID CORROSION

Chemical Inhibitor Also a Detergent

More and more refineries are finding Polyrad an excellent inhibitor in the control of internal corrosion and plugging of equipment. Polyrad, a development of Hercules research, helps maintain throughput, increases heat transfer, reduces metal loss, and cuts downtime for maintenance.

A derivative of an organic amine, Polyrad forms a molecular film that shields refinery equipment from hydrogen-ion attack by organic and inorganic acids. It functions efficiently under acid conditions—low concentrations giving better than 99 percent protection to mild steel immersed in strong hydrochloric acid. It can also be used in conjunction with ammonia or alkalies and is effective up to 500°F. Polyrad economically controls corrosion in the refinery—from crude units to gas plant areas.

The detergent action of Polyrad is a unique plus feature. It loosens iron sulfide and other scales; permits them to be dispersed in the fluid stream and removed from process equipment.

Polyrad is readily available from stocks carried at convenient locations. For further information, write Hercules.

POLYRAD®

A Hercules Rosin Amine Derivative

Naval Stores Department
HERCULES POWDER COMPANY
984 Market Street, Wilmington 99, Del.

(To obtain more data on advertised products see page 424)

ADVERTISERS' INDEX

This index is published as a convenience to the reader. Every care is taken to make it accurate, but PETROLEUM PROCESSING assumes no responsibility for errors or omissions.

FOR INFORMATION ON ANY PRODUCT OR SERVICE ADVERTISED IN THIS ISSUE SEE INSTRUCTIONS BELOW

Each advertiser listed in this index has been assigned a code letter for use by the reader in securing additional information about advertised products or services which interest him. This code letter appears in parentheses to the left of the advertiser's name.

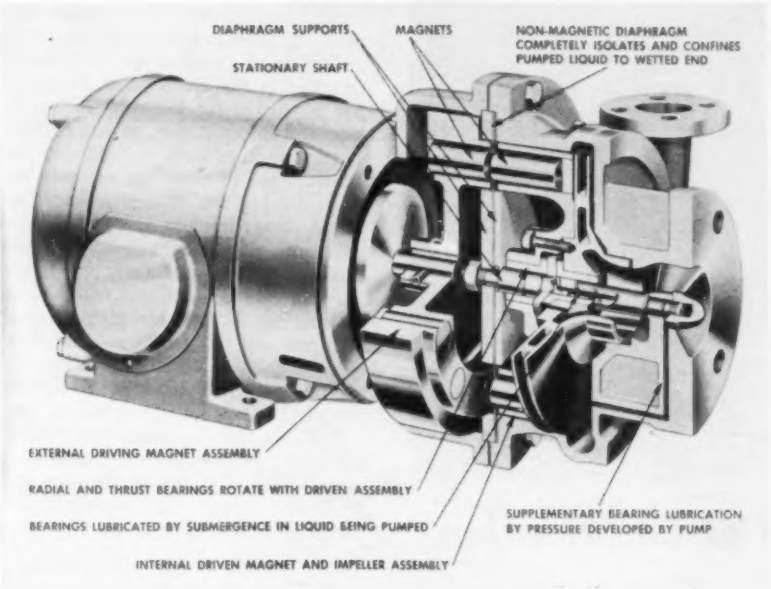
Circle the code letter on the "Advertised Product Inquiry" card (on the page opposite) which corresponds to that assigned the advertiser about whose product you want further information.

Fill in your name, title, company and mailing address and mail the card . . . no postage is required.

The Petroleum Processing Reader Service Department will give your inquiries prompt and efficient handling.

(A-1) Airetool Mfg. Co., The 428
(A-2) Air Preheater Corp. 333
(A-3) Allied Chem. & Dye Corp., Gen'l. Chem. Div. ..... Cover 3
(A-4) Aluminum Co. of America, Electrical Products Div. 321
(A-5) American District Steam Co., Inc... 329
(A-6) American Locomotive Co. 330, 331
(A-7) American Brass Co. 325
(A-8) Atlantic Refining Co. 308
(A-9) Babcock & Wilcox Co. 414
(B-1) Beckman, Inc., Arnold O. 411
(B-2) Beckman Instruments 418
(B-3) Bethlehem Steel Corp. 322
(B-4) Black, Sivalls & Bryson, Inc., Safety Head Div. 429
(B-5) Calumet & Hecla, Inc., Wolverine Tube Div. 440
(B-6) Carey Mfg. Co., Philip 317
(B-7) Catalytic Construction Co. 323
(B-8) Central Scientific Co. 338
(B-9) Chicago Bridge & Iron Co. 377
(C-1) Chiksan Co. 334
(C-2) Cooper-Bessemer Corp. 307
(C-3) Crane Co. 332
(C-4) Crane Packing Co. 398
(C-5) Crawford Fitting Co. 403
(C-6) Cushman Motor Works 431
(C-7) Dowell, Inc. 344
(C-8) DuPont de Nemours & Co., Inc., E. I. 400
(C-8) DuPont de Nemours & Co., Inc., E. I. 312A, 312B
(C-9) Durametallic Corp. 405
(D-1) Electric Auto-Lite 438
(D-2) Enjay Co., Inc. 296
Ethyl Corp. ..... Between Cover 2 and page 293
(D-4) Fielden Instrument Div. 404
(D-5) Flint Steel Corp. 439
(D-6) Fluor Corp., Ltd., The 320
(D-7) Foster Wheeler Corp. 408A, 408B
(D-8) Foxboro Co., The 324
(D-9) Gas Atmospheres, Inc. 430
(E-1) Gen'l. Amer. Trans. Corp., Terminal Div. 298
(E-2) Gen'l. Amer. Trans. Corp., Wiggins Gasholder Div. 427
(A-3) Gen'l. Chem. Div., Allied Chem. & Dye Corp. .....Cover 3
(E-3) General Electric Co. 340, 341
(E-4) General Refractories Co. 315
(E-5) Girdler Corp., The 438
(E-6) Globe Steel Tubes Co. 378
(E-7) Graver Tank & Mfg. Co., Inc. 302
(E-8) Harshaw Chemical Co. 347
(E-9) Hartzell Propeller Fan Co. 294
(F-1) Hercules Powder Co. 423
(F-2) Hetherington & Berner, Inc. 431
(F-3) Hoke, Inc. 394
(F-4) Homestead Valve Mfg. Co. 421
(F-5) Hooker Electrochemical Co. 345
(F-6) Hudson Engineering Corp. ..... Cover 2
(F-7) Industrial Models, Inc. 442
(F-8) Instruments, Inc. 442
(F-9) International Nickel Co., The 412
(G-1) Johns-Manville Corp. 433
(G-2) Kaiser Engineers 415
(G-3) Kellogg Co., The M. W. Fabricated Products Div. 313
(G-4) Kellogg Co., The M. W., Chemical Process Div. 392A, 392B
(G-5) Key Co. 444
(G-6) Kuljian Corp., The 420
(G-7) Littleford Brothers, Inc. 441
(G-8) Lukens Steel Co. 335
(G-9) Lummus Co., The 301
(H-1) McGraw-Hill Book Co. 416
(H-2) McKee & Co., Arthur G. 343
(H-3) Meriam Instrument Co., The 407
(H-4) Micro Metallic Corp. 443
(H-5) Midvale Co., The 306
(H-6) Mixing Equipment Co. 348
(H-7) National Lead Co. 399
(H-8) Nicholson & Co., W. H. 305
(H-9) Nordstrom Valve Div., Rockwell Mfg. Co. 344A, 344B
(I-1) Norton Co. 402
(I-2) Oakite Products Co. 435
(I-3) Ohio Injector Co. 336, 337
(I-4) Orbit Valve Co. 316
(I-5) Oronite Chemical Co. 408
(I-6) Palmer Thermometers, Inc. 422
(I-7) Petroleum Rectifying Co. 346
(I-8) Pfaudler Co., The 380
(I-9) Powell Co., The Wm. 396
(J-1) Pressed Steel Co., The 328
(J-2) J. F. Pritchard Co. of California .. 312
(J-3) Refinery Supply Co. 434
(J-4) Ridge Tool Co., The 417
(H-9) Rockwell Mfg. Co., Nordstrom Valve Div. 344A, 344B
(J-5) St. Mary Iron Works 441
(J-6) Sier-Bath Gear & Pump Co. 442
(J-7) Smith Corp., A. O. 326, 327
(J-8) Taylor Forge & Pipe Works 339
(J-9) Taylor Instruments 342
(K-1) Tennessee Corp. 395
(K-2) U. S. Gasket Co. 432
(K-3) U. S. Stoneware Co. 436
(K-4) Universal Oil Products Co. ... 318, 319
(K-5) Vernon Tool Co. 434
(K-6) Vogt Machine Co., Henry 392
(K-7) Warner Lewis Co. 438
(K-8) Warren Petroleum Corp. 293
(K-9) Western Supply Co. 447
(L-1) Wiedeke Co., Gustav 405
(B-5) Wolverine Tube Div., Calumet & Hecla, Inc. 440
(L-2) Wright Chemical Corp. 437
(L-3) Wyatt Metal & Boiler Works ...Cover 4
(L-4) Yarnall-Waring Co. 314
(L-5) Zallea Brothers 406

WHAT'S NEW . . .


DIAPHRAGM SUPPORTS
MAGNETS
NON-MAGNETIC DIAPHRAGM COMPLETELY ISOLATES AND CONFINES PUMPED LIQUID TO WETTED END
STATIONARY SHAFT
EXTERNAL DRIVING MAGNET ASSEMBLY
RADIAL AND THRUST BEARINGS ROTATE WITH DRIVEN ASSEMBLY
BEARINGS LUBRICATED BY SUBMERGENCE IN LIQUID BEING PUMPED
SUPPLEMENTARY BEARING LUBRICATION BY PRESSURE DEVELOPED BY PUMP
INTERNAL DRIVEN MAGNET AND IMPELLER ASSEMBLY

New Magnetic-drive Pump Developed

Complete isolation and confinement to the wetted end is provided for liquids being handled in a new magnetic-drive, horizontal centrifugal pump. The unit has no rotating seals, no packing, and no rotating member between the driver and the driven section. Power is transmitted from motor to pump by employing the principle of matching magnetic fields. from adjacent opposite poles, mounted around the periphery of the driving and driven elements.

A circular disc, with 12 to 24 permanent magnets (depending upon pump size) is attached to the rotating motor shaft. This drives a similar size permanent disc magnet and impeller unit, which is attached to and rotates around a stationary shaft in the liquid end. A non-magnetic diaphragm separates the two ends.

At present, the pump can be powered by motors with ratings of 1, 1½, and 2 hp., operating at 1760 rpm. Motor can be of standard, totally-enclosed or explosion-proof design, with any required electrical characteristics. Pump size is 1 x 2½ x 8 in. only.

Expected applications include lines handling hazardous, toxic, or odoriferous pumpable liquids, or for extremely hot or cold liquids as well as those with highly corrosive properties. Fluids handled in actual installations include ammonia, liquid chlorine, organic acids, and water.

Because of the isolation feature, capacity and head considerations have been of secondary importance. In the size indicated, maximum capacity available is 150 gpm.; maximum head is 70 ft. Ratio of head and capacity for any given application will be determined by liquid viscosity, specific gravity, and maximum motor hp.

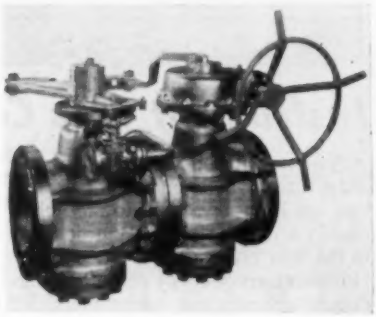
Materials of construction used have been Carpenter No. 20 stainless steel, bronze-fitted cast iron, and all bronze. Almost any material can be furnished as long as a non-magnetic diaphragm can be used. Limitations of applications are set first by the 2 hp. maximum power and second, by the non-handling of abrasive liquids, since the pump bearings are lubricated by the liquid passing through the pumps.

As yet, an insufficient number of the units have been built to bring costs into competitive relationship with conventional pumps with the same head-capacity characteristics. Beyond the 2 hp. size, several 10 hp., 3460 rpm. units, with 250 psi. operating pressure, driving vertical pumps with completely enclosed design are now in commercial operation for specific applications, worked out in cooperation with a user. Units of this type can be designed to meet application requirements, if the application warrants the costs involved. Peerless Pump Div., Food Machinery & Chemical Corp., 301 West Avenue 26, Los Angeles 31, Calif.

Circle No. **1** *on Reply Card*

For More Information

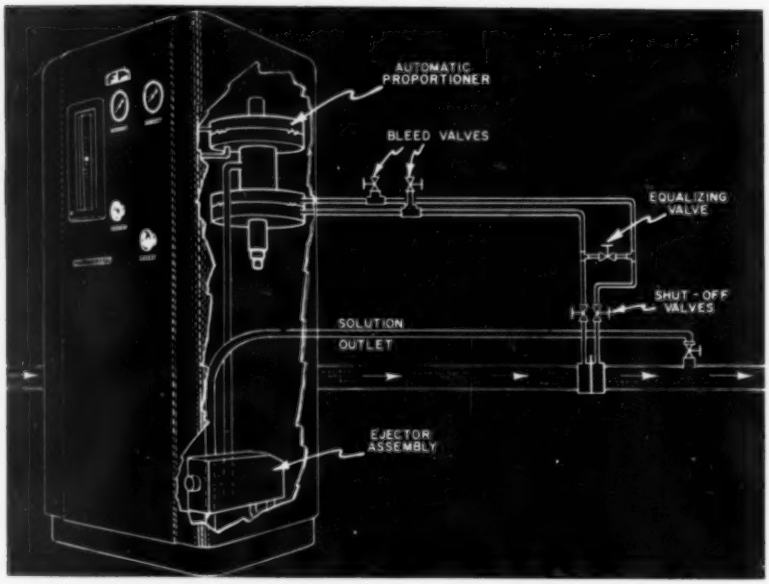
Use one of the attached reply cards to request additional details or literature on any items reviewed in "What's New!" Just circle the numbers corresponding to the numbers at the end of each item in which you are interested. Then fill in the rest of the card and drop it in the mail. No postage is required.



New Line Blind Uses Double Block with an Automatic Bleed

. . . eliminating shut-off of upstream and downstream valves and bleeding the section between blinds. Drainage losses are thus avoided, as well as the danger of large volumes of escaping vapor such as, for example, those given off by LPG during draining. Believed to be the first major innovation of its type since positive blinding, the new "Rockwell Blind" consists of two straightway "Nordstrom Hypreseal" plug valves butted together in series and operated in unison through a common linkage. A bleeder valve, located between the two plugs, is also operated through the same linkage in such a way that when the two plugs are closed the bleeder is automatically opened. Precise piping alignment is not needed to prevent binding when the new blind is used. An additional safety feature, particularly where LPG is used, is that the blind prevents pressure build-up and the resulting hazards of conventional blinds. The unit also has a tamperproof locking device and simple, one-wheel operation. Rockwell Mfg. Co., 400 North Lexington Ave., Pittsburgh 8, Penna.

Circle No. **2** *on Reply Card*



Instrument Cuts Cost of Chlorination

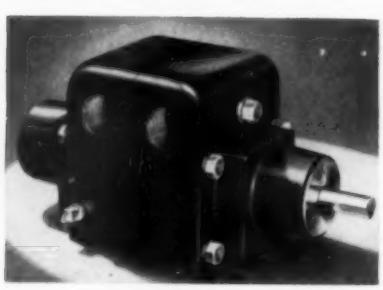
A new corrosion-resistant automatic proportioning component for chlorinators has been developed to feed chlorine in a direct and preset proportion to the flow rate, however it may vary. No ratio controllers or complex transducers or pressure transmitters are needed. This brings the cost down for a chlorinator with the instrument to less than $2,000.

The unit, illustrated in the diagram, is operated by differential pressure coming directly from an orifice plate. Once an initial setting for a desired proportion of chlorine has been made manually on the chlorine rate valve, the automatic proportioner takes over.

Designed for use with the manufacturer's standard and high capacity, vacuum-type, solution feed chlorinators, the automatic proportioner can be incorporated to make the conversion from manual rate adjustment either before shipment or after the chlorinator has been in use.

Two models are available in two standard differential ranges: 0-50 in. and 0-100 in. water column. Resistance to corrosion by moist or dry chlorine gas and to chlorine solution is provided by such construction materials as tantalum, Hastelloy "C," Uscolite, Teflon, Kel-F, Tygon, and glass. Fischer & Porter Co., 20 Jacksonville Rd., Hatboro, Penna.

Circle No. **3** *on Reply Card*



New Small Chemical Pump Has Synthetic Rubber-lined Casing

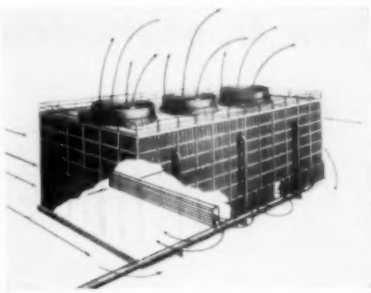
. . . suitable for most corrosive fluids. The "Rubberchem" is a positive displacement pump built for capacities up to 10 gpm. and 100 psi. operating pressures under sustained service. It is recommended for transfer of chlorine-bearing fluids, such as water, hydrochloric acid and other acids, as well as many alkalis, and organic or inorganic fluids compatible with synthetic rubber. Internal parts are available in Type 316 stainless steel or Monel metal. All parts are interchangeable with the manufacturer's standard "Allchem" stainless steel or bronze process pumps. Eco Engineering Co., 12 New York Ave., Newark, N. J.

Circle No. **4** *on Reply Card*

Trial Program Eliminates Risk In Acquisition of Infrared Units

. . . for process analysis. Under the 90-day program, a company can determine the advisability of purchasing infrared at a relatively low cost. Normally, purchase of such an instrument involves a sizeable cash outlay as well as committment of personnel. The newly announced plan works like this: A Perkin-Elmer Model 12-C single beam infrared spectrometer is installed in the user's plant. Personnel are instructed for two days on operation and interpretation of results. The basic sampling cells needed for the specific type of work are left with the user. During the 90-day period, frequent follow-ups are made to resolve problems, give added instructions, and answer any questions. Only cost to the user is for installation and two days of instruction: $450 if the instrument is returned and $200 if it is purchased. The Model 12-C is suited for routine product control. Its cost is $6400, mounted in a mobile console, and $5800 in a table-mounted type. A non-recording, point-indicating Model 12-S costs $4500. Details on the plan are available from The Perkin-Elmer Corp., Norwalk, Conn.

Circle No. **5** *on Reply Card*



Performance of Cooling Towers Is Improved in New Design

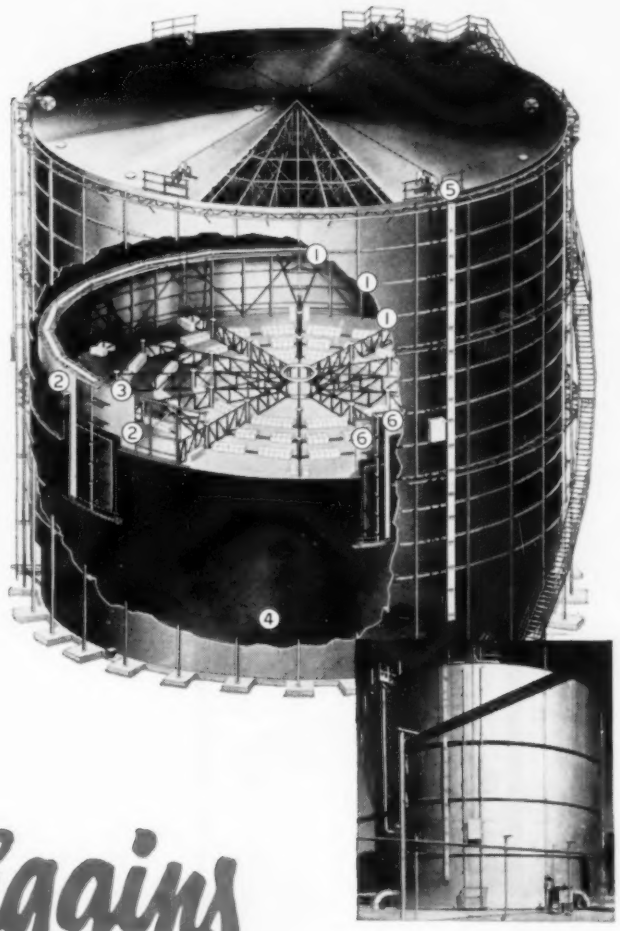
. . . which uses equalizing channels between each cell. This is said to balance pressure and reduce recirculation, long a bugaboo in impairing cooling tower performance. The channels prevent exhausted air from being forced downward into the inlet area and passing through the tower a second time, by relieving the pressure differential existing between the windward and leeward sides. During strong horizontal winds, the channels allow air to pass completely through the tower in order to equalize pressure. Locations or obstructions in the vicinity of a tower will not impede the performance of the new design, the manufacturer said, because the equalizing channels will balance pressure and reduce the recirculation under all atmospheric conditions. Santa Fe Tank & Tower Co., Los Angeles, Calif.

Circle No. **6** *on Reply Card*

no. **4** *of a series*

GUIDES TO GASHOLDER PLANNING

As production men, what we want to know is . . .



1 Top section of shell completely ventilated

2 Wide clearances simplify operation

3 Gas-tight friction-less seal not affected by weather

4 Piston rests on bottom—less than ½ of 1% for purging

5 Leveling device—independent of side-wall—keeps piston level

6 Fenders prevent all tension in seal

How weatherproof can a gasholder be?"

Will rough weather mean operating headaches? Conventional gasholders must be checked frequently to guard against weather hazards. Icy days can mean the expense of a maintenance crew chopping away profits on your gasholder to free the frozen seal. This condition means costly interruption of service.

Only the Wiggins Gasholder has the patented Wiggins *dry* fabric seal. There's no water, tar or grease to service—nothing to freeze, evaporate, blow out or leak.

How weatherproof can a gasholder be? Performance of the Wiggins Gasholder has been proven in over 15 years of field operation—with installations from coast to coast, from the Gulf to Canada, and in Iceland and Brazil.

Write General American for the complete facts.

Wiggins Gasholder

WIGGINS VAPOR SEALS GENERAL AMERICAN TRADE MARK

GENERAL AMERICAN TRANSPORTATION CORPORATION

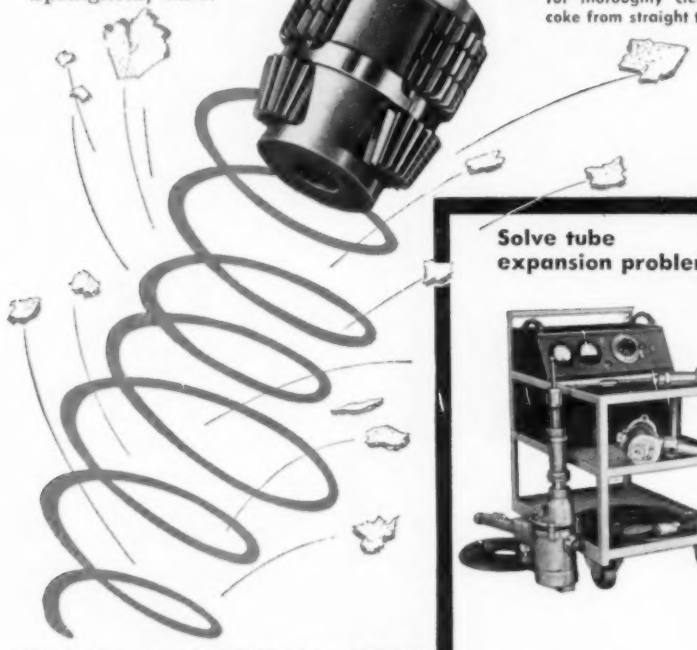
135 South La Salle Street • Chicago 90, Illinois • **Offices in Principal Cities**

ALWAYS a good job well done...

with AIRETOOL tube cleaners and expanders

For really effective tube cleaning in any refinery unit, tools must have power—power to rapidly and efficiently remove hard-rock coke deposits. AIRETOOL high speed motors have that power. Ball bearing thrusts at both front and rear assure constant torque at all speeds—loaded down to as low as 50 RPM, they will not bog down or stall! All AIRETOOL motors are tough but still easily maintained; all parts are ground to a slip-fit requiring no special tools. See how easily you can save time and money on tube maintenance; write to The AIRETOOL Manufacturing Co., 336 S. Center St. Springfield, Ohio.

AIRETOOL series "6000" ball bearing motor, shown with single expansion type cutter head for thoroughly cleaning coke from straight tubes.



There's an AIRETOOL TUBE CLEANER and TUBE EXPANDER for Every Type of Tubular Construction

Solve tube expansion problems

For accurate, consistent rolling of condensers or heat exchangers, tube ends, AIRETOOL Tube Expansion System automatically rolls joints to uniform and maximum tightness, eliminating all possibilities of over-expansion of tubes and distortion of tube sheet.

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

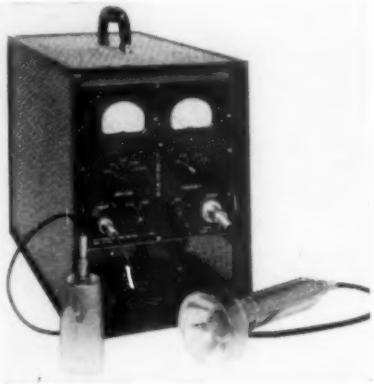
Representatives in principal cities in U.S.A., Canada, Mexico, South America, England.

Branch Offices: New York, Tulsa, Philadelphia, Houston, Baton Rouge, Chicago, Hudson Heights, N. J.

Faster Installations Result with Armored Instrument Tubing

. . . on moderate to long runs of quantities of ½-in. and smaller sizes. The "Crescent Armored Multitube" is an armored group of long length tubes twisted together to permit bending without any distortion; they are protected against injury during and after installation by the flexible, interlocked, galvanized steel outer sheath. One tube in each layer has a bright blue color, which permits ready identification of each tube at both ends. Installers can make connections quickly without tracing. The position of each tube in each layer, with respect to the colored tube in that layer, remains the same throughout any length of the Multitube. Two to 19 tubes in ¼-in. O.D. copper and aluminum are available normally from factory stock. Long, continuous lengths up to 1000 ft. save waste and short ends. Crescent Insulated Wire & Cable Co., Trenton, N. J.

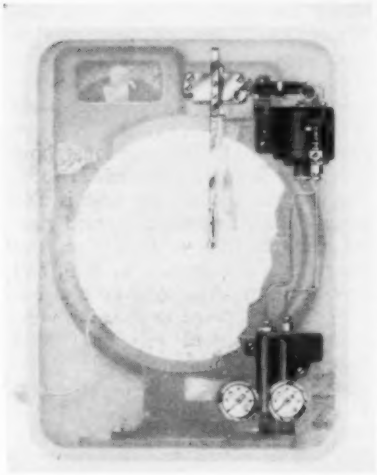
Circle No. **7** *on Reply Card*



Vibration Analyzer Permits 'In-place' Dynamic Balancing

. . . of rotating machinery. Conventional methods of dynamic balancing usually require removal of a part suspected of causing vibration to a special balancing machine. The new portable, electronic "Vibratron" and associated analysis equipment can be taken directly to the machine needing attention. In essence, the device uses a probe, or vibration pick-up, which generates electric current, this current in turn actuating a stroboscopic lamp at the frequency of the vibration. When the "strobe" light is directed at the moving part, the rotation seems to stand still or be "frozen." International Research & Development Corp., 168 East Hosack St., Columbus 7, Ohio.

Circle No. **8** *on Reply Card*



Transmitter Makes Ring Balance Meter Useful in Remote Control

. . . or measuring applications. This includes installations requiring reset, remote adjustable set point, and rate action. The signal transmitter is actuated by movement of the pen arm of indicator follower without introducing any perceptible load on the sensing element. These movements are transmitted to a baffle which moves about a fixed pivot to throttle air discharge from the control nozzle. Available maximum signal pressure ranges are 15, 30, and 60 psi., requiring a continuous supply of compressed air. Change from one signal range to another requires only the substitution of the proper calibrating spring. The minimum signal pressure may be substantially zero, or it may be suppressed to 3 or 5 psi. A built-in proportional-band adjustment is adjustable over a continuous range from 10 to 300%. Adjustment can be made at any time without affecting the zero setting. Hagan Corp., Pittsburgh, Penna.

Circle No. **9** *on Reply Card*

Fluorocarbon Plastic Hose Has Temperature Range to 500° F.

. . . with lower limit of —100° F. The basic material in its manufacture is polytetrafluoroethylene, more com-

Each Kel-F lined rupture disc is given a leak detector test and must be proven pin-hole free.

The large stock of controlled ductile metals used in the manufacture of BS&B rupture discs enables us to duplicate a previous requirement as well as affording you a wide selection in pressures — from 5 to 50,000 lbs.

For CORROSIVE Conditions

Equip Your SAFETY HEADS With BS&B Kel-F Lined Rupture Discs!

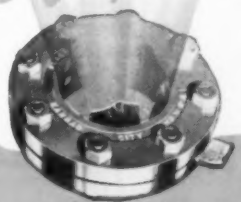
Whenever BS&B Safety Heads are installed in a location where corrosive conditions exist, an unprotected metal rupture disc may be vulnerable to corrosive attack from either the product or the atmospheric side—or both.

The recommended disc to use under these circumstances is the BS&B Kel-F lined rupture disc, which has for more than 3 years proven its resistance to corrosive attack from strong acids, caustics, chlorine, etc. Kel-F is a trade name for a thermo-plastic film of trifluorochlorethylene, which is also known by the trade name of Trithene. Discs may be specified with the Kel-F lining on either or both sides, as your conditions may require.

The use of Kel-F linings in combination with metals of known mechanical and metallurgical qualities such as Inconel, Monel, stainless steel, nickel and Hastelloy B means positive, trouble-free protection in highly corrosive applications heretofore impossible.

Thus, through "know-how" attained by years of experience in this highly technical field, BS&B has again provided the Process Industries with a *better* safety device for the protection of closed pressure systems!

BS&B Safety Heads

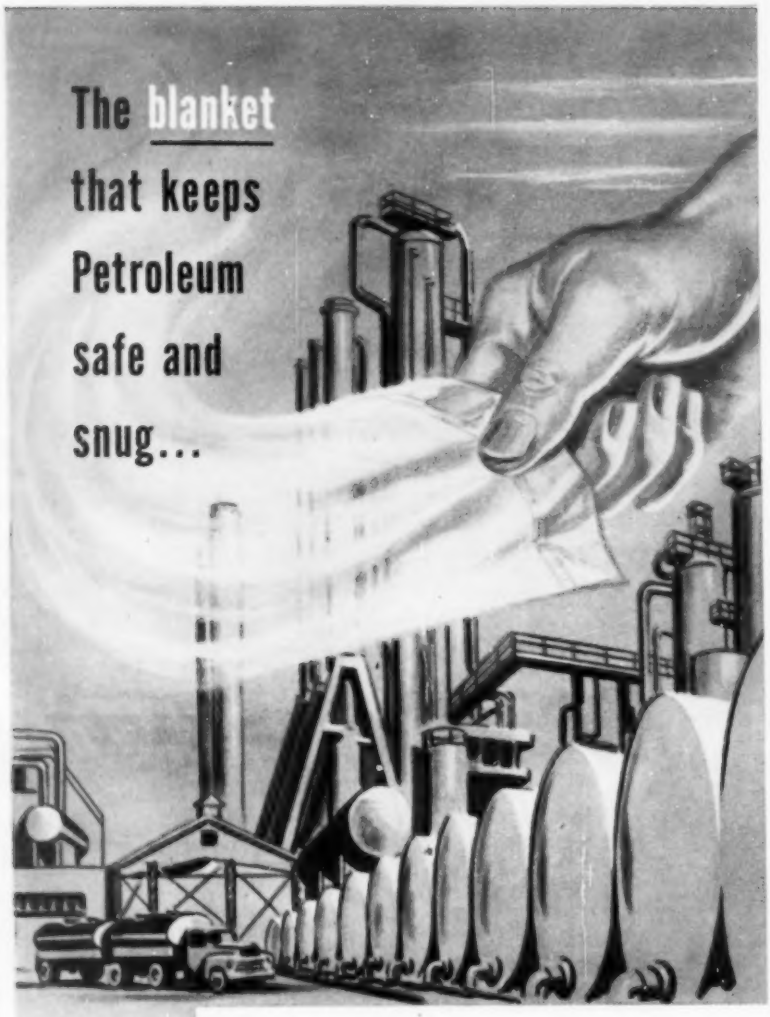


For full information on the BS&B Kel-F lined rupture disc and its application to your specific problem, consult your BS&B Office or Representative . . . or write to us direct.

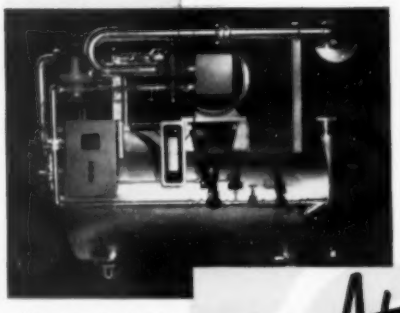
THE "CIRCUIT-BREAKER" OF *Any Pressured System*

BLACK, SIVALLS & BRYSON, INC.
Safety Head Division, Dept. 2-D3
7500 East 12th St., Kansas City 26, Mo.

EFFICIENCY OVER 60 YEARS BS&B RELIABILITY



● The processing of petroleum, paint and varnish and like products where volatile fumes are present used to be a dangerous job. Today, this danger has been minimized through the use of the inert gas blanket that holds oxygen away from the fumes, preventing the combustible mixture that made this work hazardous.



Modern gas generation equipment has made it possible for even the small processing plants to obtain this inert blanket protection at unbelievably low cost. If you are buying gas, or manufacturing it by old obsolete methods, it will pay you to drop a card to Gas Atmospheres, Inc., today.

Compact in design the Gas Atmospheres Inert Gas generator is available in a complete size range to produce any volume of gas required.

gas Atmospheres, inc

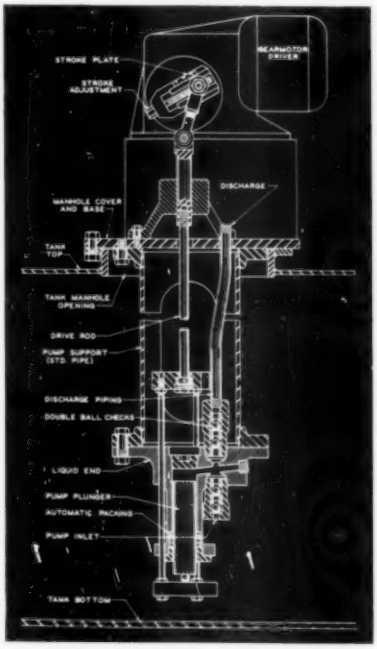
equipment for producing industrial gases

20011 WEST LAKE ROAD CLEVELAND 16, OHIO

A LEE WILSON ENTERPRISE

monly known as Teflon. The new "Fluoroflex-T" line of hose, said to have application in handling many corrosives including some of the newer synthetic oils and lubes, is available in a range of seven sizes from ¼ through 1 in. Three additional hose sizes are scheduled to be added soon. The material used in the hose is also being made up with a laminated glass fabric in the form of rigid pipe. The pipe is available in 1, 1½, 2, 3, and 4 in. diameters. The material also has good dielectric properties and low power loss: 400 volts per mil. and 0.0005 power factor. Resistoflex Corp., Belleville, N. Y.

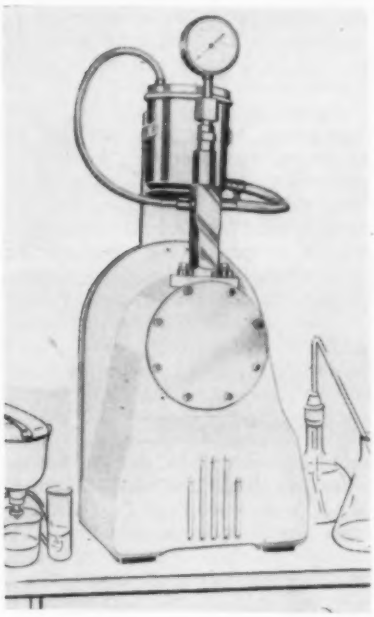
Circle No. **10** *on Reply Card*



Submerged, Controlled Volume Pump Has No Leakage Problem

. . . because it is completely surrounded by the liquid being pumped. The new "Mersemetric" pump has no diaphragm or open seal. The unit is available in a wide variety of materials of construction, depending upon the corrosivity or other properties of the fluid to be handled. It meters by direct volumetric plunger displacement with double ball checks on both suction and discharge strokes. Capacities range from 3 mm./hr. to 400 gal./hr., with pressure ranging up to 1000 psi. A screw adjustment varies the throw of the connecting rod, thus shortening or lengthening plunger stroke. Milton Roy Co., 1300 East Mermaid Lane, Philadelphia 18, Penna.

Circle No. **11** *on Reply Card*



New Homogenizer Meets All Requirements for the Laboratory

. . . for processing and testing. Product is separated completely from the drive mechanism, since processing takes place in a closed system and is not exposed to the atmosphere. The homogenizer head can be removed for autoclaving. Pressures range from 0 to 3000 psi. or higher; process quantities from 1 cc. to 25 gal./hr. All metal parts in contact with the product are of Type 316 stainless steel. Self-priming, the unit is portable, with a self-contained ¾ hp., 3-phase, 60 cycle, a.c. motor. D.c. and other types are also available. The complete unit includes a pressure gage, reservoir, and Tygon tubing. C. W. Logeman Co., 633 Bergen St., Brooklyn 17, N. Y.

Circle No. **12** *on Reply Card*

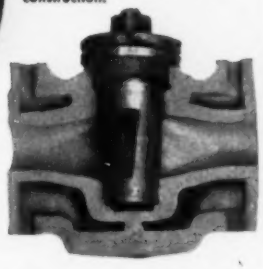
New pH Meter Accommodates Almost All Range Combinations

. . . of recorders and meters, according to the manufacturer. Its cir-

H&B ESTABLISHED 1887

At left: Jacketed 3-Way Plug Cock.

Below: Cutaway section of Jacketed Cock, showing packing gland construction.



Jacketed Pipe, Pumps, Valves and Fittings . . .

Jacketed Motor, with set-back register, for measuring viscous liquids.

for maintaining uniform temperatures (hot or cold) in process pipes

Regardless of whether the material is being heated or cooled in the processing, and what heating or cooling medium is being used, H & B jacketed fittings are available for all applications. Steam, hot water or hot oil may be used for heating, cold water or brine for cooling.

H & B can save you money on your jacketed pipe and fitting requirements because we buy all standard size pipe from the mill in carload lots, make our own special flanges in quantities, and are tooled up for making jacketed equipment at lowest possible price. Write for Bulletin J-50.

HETHERINGTON & BERNER INC.

715 KENTUCKY AVE. INDIANAPOLIS 7, IND.

NOW! SHAFT DRIVE POWER in LIGHT hauling!

TOTAL OPERATING COST ¾¢ PER MILE

- EXTRA POWER
- EXTRA CAPACITY
- EXTRA ECONOMY

Slash inner plant handling and delivery costs as have hundreds of other plants. Put Cushman 780 TRUCKSTERS on your jobs—NEW this year with SHAFT DRIVE. Complete with 3 speeds forward, one reverse. Get the EXTRA power advantages of big vehicle shaft drive—plus quick, easy handling AND low operating cost—less than a penny a mile. With capacity up to 500 pounds, TRUCKSTER can speed up hundreds of handling jobs for you!

Cushman

780 SHAFT DRIVE TRUCKSTER

- Write for FREE illustrated booklet
- See Your Nearest Cushman Dealer for FREE demonstration

SOLD and SERVICED NATIONALLY

CUSHMAN MOTOR WORKS, INC. 963 No. 21st St. Lincoln, Nebraska

(To obtain more data on advertised products see page 424)

Pick your valve and pump packing

ALL TEFLON • ALL LOW FRICTION LOAD • ALL-CHEMICAL RESISTANT

Chemiseal V-Type Packing

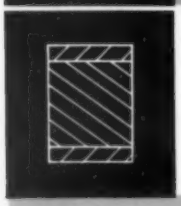
Made of low friction, chemically inert TEFLON, its distinctive tapered V design offers greater flexibility and resiliency. Provides necessary seal at low gland pressure, reducing torque required to operate manual, air or motor-operated valves.

Chemiseal Cup-and-Cone Type Packing

A ruggedly constructed TEFLON Packing for both hand and mechanically-operated valves. When pressure is applied to this cup-and-cone packing, the cones deform inwardly to effect a seal at the spindle, while the cups expand outwardly against the stuffing box—resulting in a tight seal with minimum friction on the valve stem.

Chemiseal Wedge-Type Packing

This TEFLON Packing is designed to offer the unusually low gland pressure required for use in valves made of such materials as ceramics, Haveg, Karbate, glass-lined steel, etc. Offering many of the advantages of soft packings—plus the chemical resistance of TEFLON—it also provides space for thermal expansion and is adaptable to spring loading.



Chemiseal Pump Packing

Made in three types—pure TEFLON, TEFLON with Graphite and TEFLON with Mica. Handle all types of corrosive materials including hazardous chemicals. Ideal for non-contaminating service in the manufacture of pharmaceuticals, biologicals, foods, etc.

• Ask for Bulletin TP-1053.

UNITED STATES GASKET COMPANY

CAMDEN 1 • NEW JERSEY

FABRICATORS OF duPont TEFLON, Kellogg KEL-F AND OTHER PLASTICS

Representatives in Principal Cities Throughout the World

cuit allows the recorder pH scale to be shifted up or down, expanded or compressed. The entire pH range or as few as 3 units can be recorded full-scale on the chart. Circuits are designed in three "plug-in" units, which can be instantly replaced by spares without disturbing panel connections. Circuit units are mounted on the inside of the meter door, with the housing itself installed permanently on a rack or panel. The door can be lifted off its hinges, enabling complete disassembly of the instrument in about 10 minutes with just a screwdriver. Accuracies within 0.02 pH in output to the recorder, as well as a much smaller than conventional instrument, have been made possible by use of miniature and sub-miniature electron tubes, printed circuits, etc. The instrument has been designed for rough usage in process operations. Filter circuits and shielding protect it against interference from motors or other electrical equipment. Rubber gaskets keep out moisture, dust, and corrosive gases. All sensitive circuits are enclosed in vapor-tight compartments. Beckman Instruments, Inc., South Pasadena, Calif.

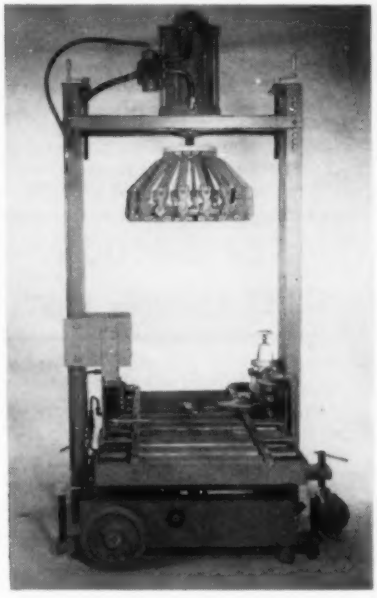
Circle No. **13** *on Reply Card*

Depth & Groove Location Gage Is Adjustable from 0 to 6¾ in.

. . . without changing the measuring rods. Indicator is an 0.0005 in. dial (Federal or equivalent). A slide-action, knurled, push-button also provides set screw adjustment to release, set, or exchange the rods. Gaging face of the anvil is hardened, ground, and lapped

square to the center line of the rod axis. Rods are Rockwell C63 hardened, and ground; 0.125 in. diameter drill rod. One end is spherical, the other ground flat and square. Complete set includes a 4¼-in. rod, 6-in. rod, and 8-in. rod, plus another 8-in. rod with a hardened foot—for gaging to recesses. Reliant Industries, 4947 Firestone Blvd., South Gate, Calif.

Circle No. **14** *on Reply Card*



New Filling, Crimping Machines Are Air-operated and Automatic

. . . as well as movable. Thus they can be set up quickly for use anywhere in the plant with complete fire safety. Shown above is the crimper. A complete assembly of filler and crimper enables a two-man crew to fill, seal, and stamp—ready for shipment—up to 15 containers per minute. Sizes of containers that can be handled range from 35-lb. (5 gals.) to 100 and 120-lb. One man feeds containers to the filling machine platform, which accommodates and fills two in rotation. A second man places a lid on each container as it comes through from filler to crimper. The crimper requires no operator. It automatically centers the filled container under the crimping head, crimps the lid on, stamps the lid and the side, and then discharges the completed container. Units are mounted on retractable wheels. They use 80 psi. compressed air at the rate of 25 cfm., and include timing and counting instruments. Barrett Mfg. Co., Houston 4, Texas.

Circle No. **15** *on Reply Card*

J-M BLAZECRETE speeds refractory repairs...

That's why it pays you to use this hydraulic setting refractory for temperatures to 3000F

REPAIR old refractory linings—or build new ones—quickly and economically with Blazecrete*. For troweling, just mix Blazecrete with water as you'd mix ordinary concrete . . . then slap-trowel it in place.

When gunned, it adheres readily with a minimum of rebound loss. Either way, Blazecrete goes on fast . . . without laborious ramming or tamping. *And Blazecrete linings last.*

Three types of hydraulic-setting Blazecrete are available. All harden on air curing, do not require prefiring. They are furnished as a dry mix . . . can be stored safely for use as needed.

3X BLAZECRETE—For temperatures through 3000F. Unusually effective for heavy patching, especially where brickwork is spalled or deeply eroded. Excellent for forge furnace linings, lime kilns, burner blocks, soaking pits, and industrial boilers.

STANDARD BLAZECRETE—For temperatures through 2400F. Makes repair work easier and less costly. Can be used by boiler manufacturers to replace fire clay tile in wall construction. Suitable for use in combination with 3X Blazecrete and L. W. Blazecrete.

L. W. BLAZECRETE—For temperatures through 2000F. An insulating refractory . . . light in weight, low in thermal conductivity. Adaptable and economical for many other applications.

Send for Brochure RC-28A on Blazecrete and its companion material, Firecrete*. . . the hydraulic setting castable refractory for making special shapes and linings. Write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.

*Reg. U.S. Pat. Off.

Whether you gun it... *or slap-trowel it...*

JM PRODUCTS **Johns-Manville BLAZECRETE**

BUILDS BETTER REFRACTORY LININGS

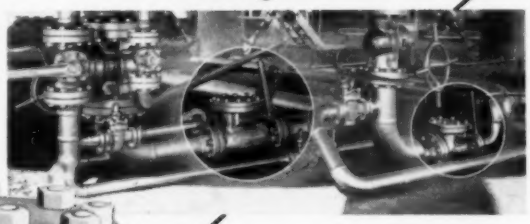
(To obtain more data on advertised products see page 424)

YOU CAN'T ALWAYS STOP FIRE BUT YOU CAN

● Here's about the cheapest kind of fire insurance you can buy. Install GREENWOOD Triple-Action Quick-Closing Valves on all lines and tanks handling volatile or combustible products . . . and get effective protection against fire — day and night, year after year. Fire melts fusible link, closing valve instantly. In emergency, valve may be closed manually by remote control or by pressure or failure of air . . . thus preventing the spread of fire.

GREENWOOD Triple-Action Quick-Closing Valves are regularly made of cast steel with stainless steel trim. For chemical, acid, or other special services these valves can be furnished in monel, stainless steel or other alloys with proper trim for the particular service. Available in 1", 2", 3", 4", 6" and 8" pipe sizes.

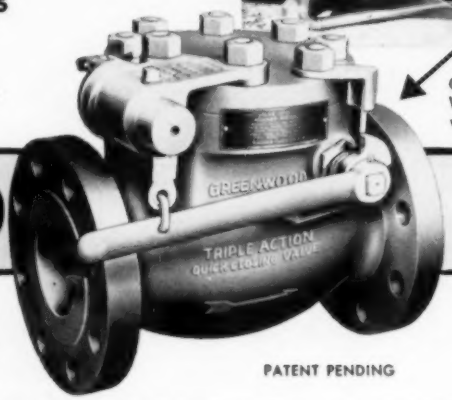
give your plant and equipment this added protection against the damages of fire!



GREENWOOD Triple-Action Quick-Closing Valves in use on pressure storage tanks where highly volatile products are stored

VALVE MAY BE CLOSED 3 WAYS

1. FIRE MELTS FUSIBLE LINK.
2. REMOTE MANUAL CABLE CONTROL.
3. APPLIED AIR PRESSURE OR AIR FAILURE.



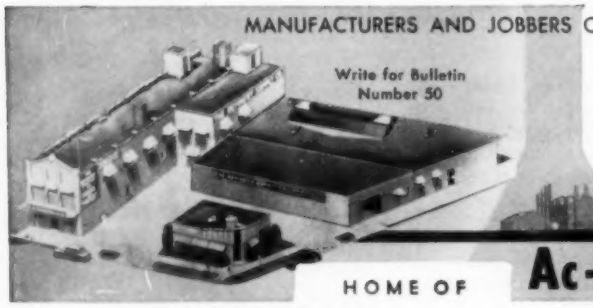
PATENT PENDING

GREENWOOD

TRIPLE-ACTION QUICK-CLOSING VALVE

GREENWOOD VALVE DIVISION
VERNON TOOL CO., LTD.
1099 Meridian Ave. Alhambra, Calif.
P. O. Box 7555 Houston 7, Texas

Write for copy of Bulletin GV-3 showing the complete line of GREENWOOD Valves



MANUFACTURERS AND JOBBERS OF **SCIENTIFIC INSTRUMENTS**

Write for Bulletin Number 50

HOME OF **Ac-Me & R. S. SPECIALTIES**

Ac-Me RECORDING GRAVITOMETER
Ac-ME SPECIFIC GRAVITY GAS BALANCE
Ac-Me PRESSURE VACUUM PUMP
R. S. MERCURY CLEANER
R. S. MANOMETER
R. S. DEAD WEIGHT GAUGE
R. S. DEAD WEIGHT TESTER
R. S. ORIFICE WELL TESTER
R. S. MOISTURE TESTER
R. S. FLAT BORE YEL-O-BAK THERMOMETERS
R. S. STREAMLINED HYDROMETERS
R. S. PULSAMETER
R. S. PRESSURE HYDROMETER JARS
R. S. VAPOR PRESSURE BOMB
R. S. DIAMOND CORE DRILL
R. S. THERMO PLUMB BOB THERMOMETERS
R. S. SUPER PRESSURE CONSISTOMETER
R. S. SMOKE METERS

COMPLETE LINE OF SCIENTIFIC LABORATORY EQUIPMENT INCLUDING CENTRAL SCIENTIFIC SPECIALTIES

cenco

Cenco . . . one dependable source of supply for everything you need in scientific instruments and laboratory supplies. Over 15,000 items . . . 14 branch offices and warehouses.

R.S.C.

REFINERY SUPPLY COMPANY
621 EAST FOURTH STREET • TULSA 3, OKLAHOMA
2215 McKINNEY AVENUE • HOUSTON 3, TEXAS

CENTRAL SCIENTIFIC COMPANY
1700 IRVING PARK ROAD • CHICAGO 13, ILLINOIS
CHICAGO NEWARK BOSTON WASHINGTON DETROIT SAN FRANCISCO
SANTA CLARA LOS ANGELES TORONTO MONTREAL VANCOUVER OTTAWA

Porous Metal Filter Designed For Relatively High Capacity

. . . in the range of filter areas up to 720 sq. ft. and cake space capacity up to 35 cu. ft. Filter medium is high temperature resistant porous stainless steel. Container can be either carbon steel or stainless steel. The design permits steam jacketing, high pressure construction, and ease of cleaning. The filter is recommended for clarification service and solids collection with such diverse fluids as petroleum products, water, and molten metals. Micro Metallic Corp., Glen Cove, N. Y.

Circle No. **16** *on Reply Card*

Trade Literature

Ethylene Compounds

. . . soon to be produced at a new plant now under construction at Orange, Texas, including ethylene oxide, ethylene glycol, and diethylene glycol: 33 pages giving uses, chemical and physical properties, handling and storage and safety information, reaction formulas, and analytical procedures; fully illustrated with charts, diagrams, and graphs. Nitrogen Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

Circle No. **17** *on Reply Card*

Reciprocating Plunger Pumps

. . . for pressures up to 20,000 psi. and capacities from a few cc./min. to over 900 gal./hr.; *Bulletin P-1153* also includes information on the standard stainless steel, spring-loaded double-ball check valve, and on the company's control mechanisms. Philadelphia Pump and Machinery Co., Wynnewood, Pa.

Circle No. **18** *on Reply Card*

Air-cooled Heat Exchanger

. . . booklet, pictures and text on the company's "Fin-Fan" line; covers supporting structures, driving equipment, and cooling sections. Griscom-Russell Co., Massillon, Ohio.

Circle No. **19** *on Reply Card*

Centrifugal and Turbine Pump

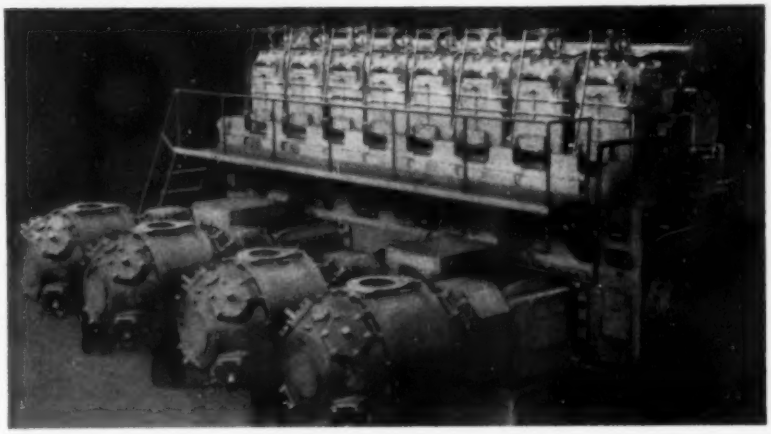
. . . selection guide and index; includes table showing how many gpm. each type of pump will deliver under various head capacities. Aurora Pump Co., Aurora, Ill.

Circle No. **20** *on Reply Card*

Valve Selection

. . . and maintenance booklet; "Getting the Most Out of Your Valves," gives data on valve types and materials as well as pointers on installation and operation. Cooper Alloy Foundry Co., Hillside, N. J.

Circle No. **21** *on Reply Card*



How one refinery eliminated scale build-up in compressors

Oakite Airefiner No. 52 prevents scale formation— cuts downtime, maintenance

Every 6 to 8 weeks a Southwestern refinery had to run acid through compressor water jackets to remove thick lime scale deposits. That meant compressors down for half a day. What could Oakite do?

The Oakite Man first descaled the jackets with Oakite Compound No. 32. Then he charged the spray pond with Oakite Airefiner No. 52, and set up a schedule for maintaining proper pH in the solution.

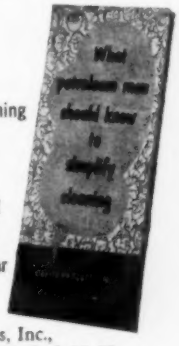
Results: Manifold temperatures reduced — no more descaling, no more cracked blocks or heads, no more compressor downtime.

Proving that — in industrial cleaning it always pays to consult Oakite.

Call your Oakite Technical Service Representative. His experience is yours to draw on. He'll study your cleaning problem, suggest and demonstrate the best material and method. He'll keep checking back to see that you get top quality cleaning at low cost. Call him today!

FREE HANDBOOK— full of facts on

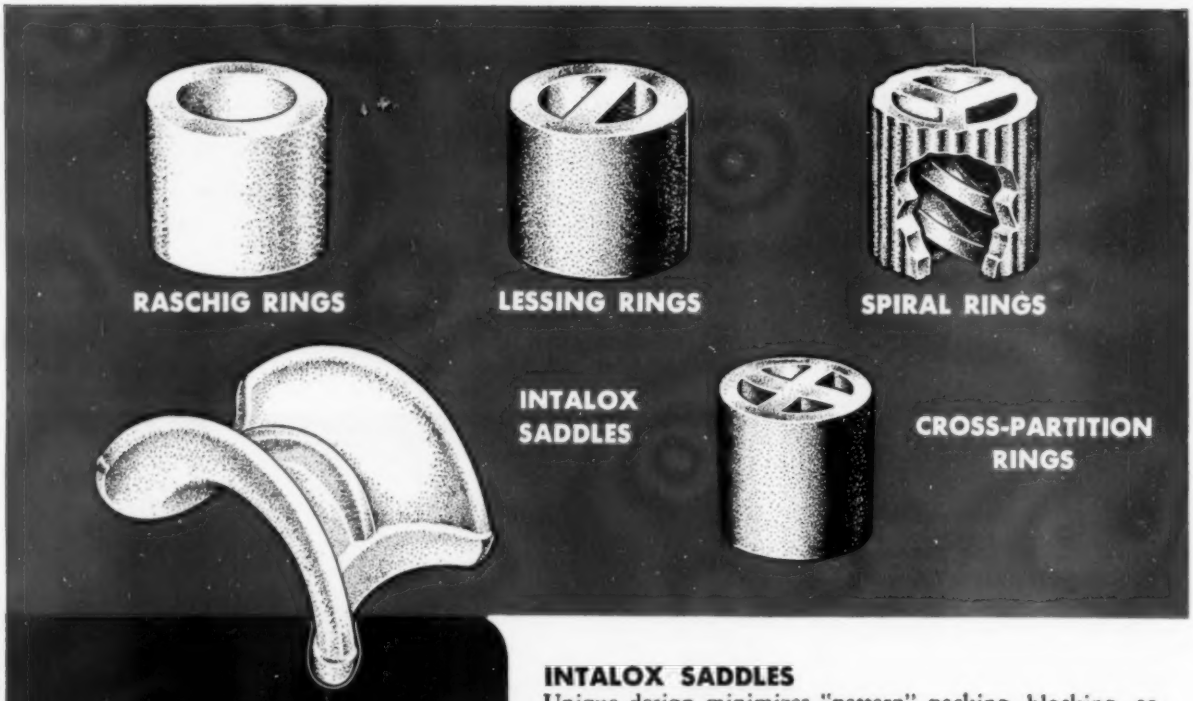
Drum reconditioning
Descaling
Cleaning tanks
Salvage cleaning
Paint stripping
Cleaning tank car interiors



Write Oakite Products, Inc., 50D Rector St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE
petroleum service division
Technical Service Representatives in Principal Cities of U. S. and Canada

(To obtain more data on advertised products see page 424)



TOWER PACKING

U. S. Stoneware offers a range of types and sizes of Tower Packings not even remotely approached by any other manufacturer . . .

INTALOX SADDLES
Unique design minimizes "pattern" packing, blocking, or nesting in dumped beds. Appreciably greater surface area. Lower pressure drop. Higher flooding limits. Made in ½" ¾", 1", 1½" and 2" sizes in both high-fired chemical porcelain and chemical stoneware.

RASCHIG RINGS
Low initial cost. Most widely used of all tower packings. Made in chemical porcelain, chemical stoneware, carbon, steel and other alloys. Size range from ¼" to as high as 6", depending upon material. Sizes up to 2" are generally dumped. Larger sizes, stacked.

LESSING RINGS
A modification of the Raschig Ring. The ring has a single partition or web added to the inside. Made in 1", 1¼", 1½" and 2" sizes in chemical porcelain or chemical stoneware. Usually dumped.

CROSS-PARTITION RINGS
A further modification of the Raschig Ring. Two inside webs cross each other at right angles to create a "4-cell" ring. Cross-Partition rings are made in 3", 4" and 6" sizes in chemical stoneware. They are usually stacked in the tower.

SPIRAL RINGS
Made in single, double or triple spiral types. The function of the spirals is to increase the turbulence of the gas stream. Made in chemical stoneware in 3¼", 4" and 6" sizes. Spiral rings are used in stacked beds.

All U. S. Stoneware ceramic tower packings are made from bodies especially developed for tower service. They are extremely tough, possess high resistance to spalling and exceptional corrosion-resistant properties. Chemical porcelain bodies are completely iron-free and are of zero porosity.

CH-D

The U. S. STONEWARE Co.
AKRON 9, OHIO

Instrument Transformer

. . . buyer's guide; 96-page publication, *GEA-4626G*, contains ratings, ASA accuracy classifications, and prices of all G-E indoor and outdoor potential and current transformers; plus tables covering the mechanical and thermal limits of current transformers. General Electric, Schenectady 5, N. Y.

Circle No. **22** *on Reply Card*

Infrared Gas Analyzers

. . . for continuous plant stream analysis of hetero-atomic gases or liquids with vapor pressures greater than 30 mm. at 25° C.; full details; *Instrumentation Data Sheet No.* 10.15-10. Station 64, Minneapolis-Honeywell Regulator Co., Wayne and Windrim Aves., Philadelphia 44, Pa.

Circle No. **23** *on Reply Card*

Oxygen Measurement

. . . in catalyst regeneration; a discussion of the importance of regeneration in catalytic cracking and the need for efficient oxygen utilization; *Bulletin* 608; also, specifications for an oxygen sampling system; *Bulletin* 701. Arnold O. Beckman, 1020 Mission St., South Pasadena, Calif.

Circle No. **24** *on Reply Card*

Diaphragm Motor Valves

. . . for wide band proportional control; high pressure type, series 800; full specifications for globe bodies rated at a maximum of 3000 psi. at 450° F. and angle bodies rated at 6000 psi. at 450° F.; 4-page *Specification Sheet* 426. Minneapolis-Honeywell Regulator Co., Wayne and Windrim Aves., Philadelphia 44, Pa.

Circle No. **25** *on Reply Card*

Chemical Feed Systems

. . . for water-treating and other applications; conventional screw and rocker-arm adjustments of pump capacity, with either manual or automatic control; *Bulletin T-1153*. Philadelphia Pump and Machinery Co., Wynnewood, Pa.

Circle No. **26** *on Reply Card*

Corrosion-resistant Pumps

. . . valves, and pipe fittings, made of Buna N, natural, and hard rubber; diagrams and performance data; *Bulletin — Buna N*. Vanton Pump & Equipment Corp., Empire State Bldg., New York 1, N. Y.

Circle No. **27** *on Reply Card*

Line Blind Valves

. . . their proper installation, common consequences of poor installation, and some easy tests for locating trouble; 24-page *Installation Manual*. Hamer Oil Tool Co., 2919 Gardenia Ave., Long Beach 6, Calif.

Circle No. **28** *on Reply Card*

Stainless Steel Filters

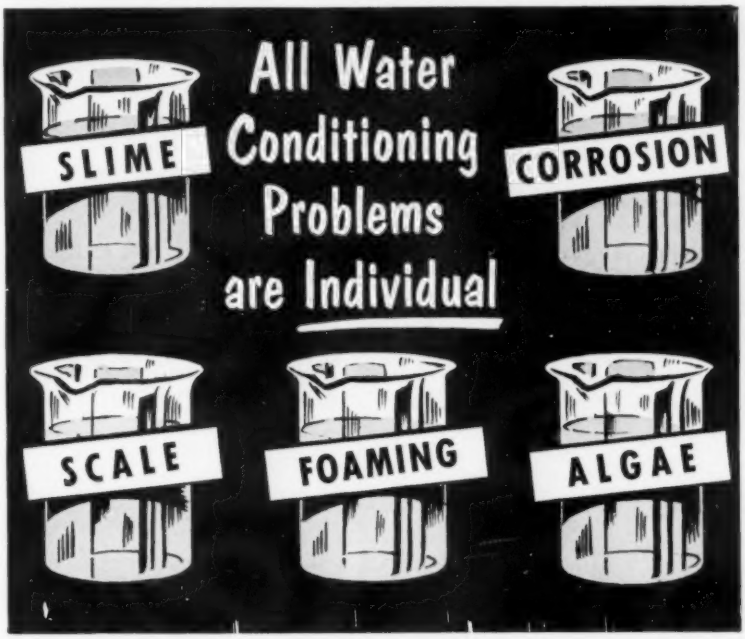
. . . for free-flowing, light to heavy bodied liquids; 4-page *Bulletin* 489 deals with tubular, pipe line and vertical floor-mounted filters. Cherry-Burrell Corp., Dept. AS-13, 427 W. Randolph St., Chicago 6, Ill.

Circle No. **29** *on Reply Card*

Sump Pump

. . . booklet describing the Johnston unit-line pump; construction details, head and capacity tables, dimensions and other data; *Bulletin* 1029. Johnston Pump Co., 3272 E. Foothill Blvd., Pasadena 19, Calif.

Circle No. **30** *on Reply Card*



Be Sure You Get the WRIGHT Answer

There simply is no *one* way of solving all water conditioning problems. Each requires individual analysis, individual solution. Wright Water Conditioning Service is based on these facts. From first to last, we treat your water conditioning as the individual problem it is, starting with a laboratory analysis as the basis of a written proposal for the solution. Upon acceptance of our recommendations, constant checks are maintained to insure efficient, economical performance. If you have a water conditioning problem, be sure you get the Wright answer. Without obligation, write, wire or call for a thorough survey by a Wright Field Engineer.

Wright CHEMICALS

WRIGHT CHEMICAL CORPORATION

GENERAL OFFICES AND LABORATORY

635 WEST LAKE STREET, CHICAGO 6, ILLINOIS

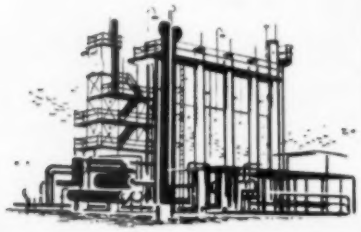
Offices in Principal Cities

- Softeners, Filters and other external Treating Equipment
- Nelson Chemical Proportioning Pumps

(To obtain more data on advertised products see page 424)

PROBLEM

To produce hydrogen essentially free of carbon monoxide which has a deleterious effect on product quality and plant capacity for edible oil producers.



SOLUTION

GIRDLER developed a highly active durable catalyst, G-12, for removal of carbon monoxide from the hydrogen. Cost of hydrogen production was reduced and carbon monoxide content was cut 95% resulting in:

Hydrogen with less than 5ppm of carbon monoxide

Take advantage of the experience of Girdler in solving *your* catalyst problems!

FOR

Catalysts

WRITE...

The **GIRDLER** *Company*

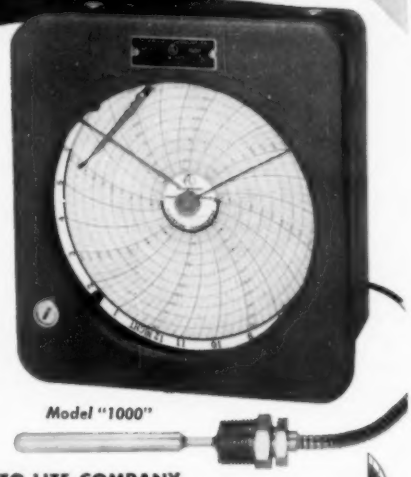
A DIVISION OF
NATIONAL CYLINDER GAS COMPANY
Gas Processes Division
LOUISVILLE 1, KENTUCKY
NEW YORK • TULSA • SAN FRANCISCO

AUTO-LITE

TEMPERATURE RECORDING...

Newly designed, Model "1000" Auto-Lite Recorder gives permanent proof of temperature behavior. • 6" clear reading chart; various standard ranges from minus 40°F. to plus 550°F. • 3 standard types; choice of 24-hr. or 7-day cycle. • Electric or mechanical chart drive. • With capillary tubing for remote reading. Priced from $49.50.

Send for new catalog describing many styles of Auto-Lite temperature Recorders and Indicators.



Model "1000"

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION
TOLEDO 1, OHIO
NEW YORK • CHICAGO • SARNIA, ONTARIO

TEMPERATURE RECORDERS

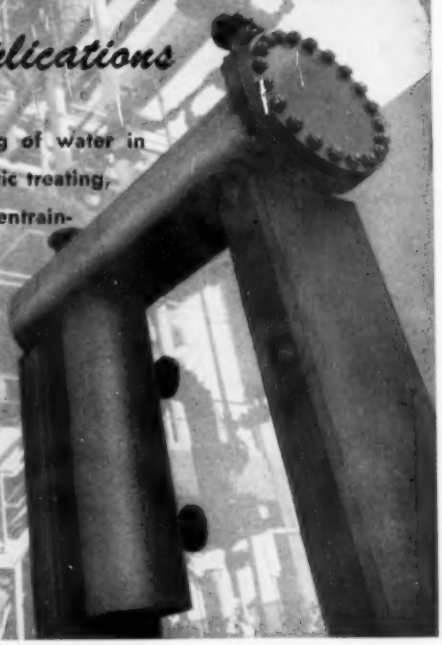
Tune in "SUSPENSE!"...CBS Radio Mondays...CBS Television Tuesdays

EXCEL-SO WATER SEPARATORS

for refinery applications

Provides continuous coalescing of water in sulphuric acid alkylation, caustic treating, polymerization, and other entrainment problems.

Write for Process Manual R-101-53



WARNER LEWIS COMPANY
BOX 3096 • TULSA, OKLAHOMA

Low Volatility Plasticizer

. . . for polyvinyl chloride; "DIDP," similar to firm's DOP but having lower volatility and giving plastisols lower initial viscosity and lower viscosity build-up than plastisols based on DOP; comparison shown between effects of DIDP and DOP on physical properties of polyvinyl; *Technical Bulletin No. O-108.* Monsanto Chemical Company, 1700 S. Second St., St. Louis 4, Mo.

Circle No. **31** *on Reply Card*

Gelling Agents

. . . for polyvinyl chloride compositions and in producing plastigels; *Bulletin G-5* describes new applications for Witco sodium stearate T-1 and aluminum stearate No. 22. Witco Chemical Co., 260 Madison Ave., New York 16, N. Y.

Circle No. **32** *on Reply Card*

Power Auger Bit

. . . for use in portable electric hand drills, rotary pneumatic drills or drill presses; specifications and sets on all sizes; folder. Chicago-Latrobe Twist Drill, 411 W. Ontario St., Chicago 10, Ill.

Circle No. **33** *on Reply Card*

An Automatic Refinery

. . . built and operated by International Refineries, Inc., at Wrenshall, Minn., is described by the company's instrument engineer in an article in *Instrumentation,* Vol. 7, No. 1. Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne & Windrim Aves., Philadelphia 44, Penna.

Circle No. **34** *on Reply Card*

Petroleum Processing Index

. . . for 1953; including subject and author indexes for all feature articles and regular departments for the 12 issues of this magazine published during the past year. NOTE: Mailing lists of index requests from previous years are not maintained. If you wish the 1953 Index, write direct to McGraw-Hill Petroleum Publications, 330 West 42nd St., New York 36, N. Y., or . . .

Circle No. **35** *on Reply Card*

Filter Aid

. . . for removing emulsified oil from condensate or process water; "Sorbocel," a "celite" diatomite powder, how it works and four case histories; brochure, *Sorbo-Cel Filtration.* Johns-Manville, 22 E. 40th St., New York 16, N. Y.

Circle No. **36** *on Reply Card*

Machining Ampco Metal

. . . coolant used, feeds and speeds; tools needed for grinding, honing and polishing, milling, broaching, sawing, etc.; *Bulletin 66a.* Ampco Metal, Inc., Milwaukee 46, Wis.

Circle No. **37** *on Reply Card*

Hot Tap Tee Connections

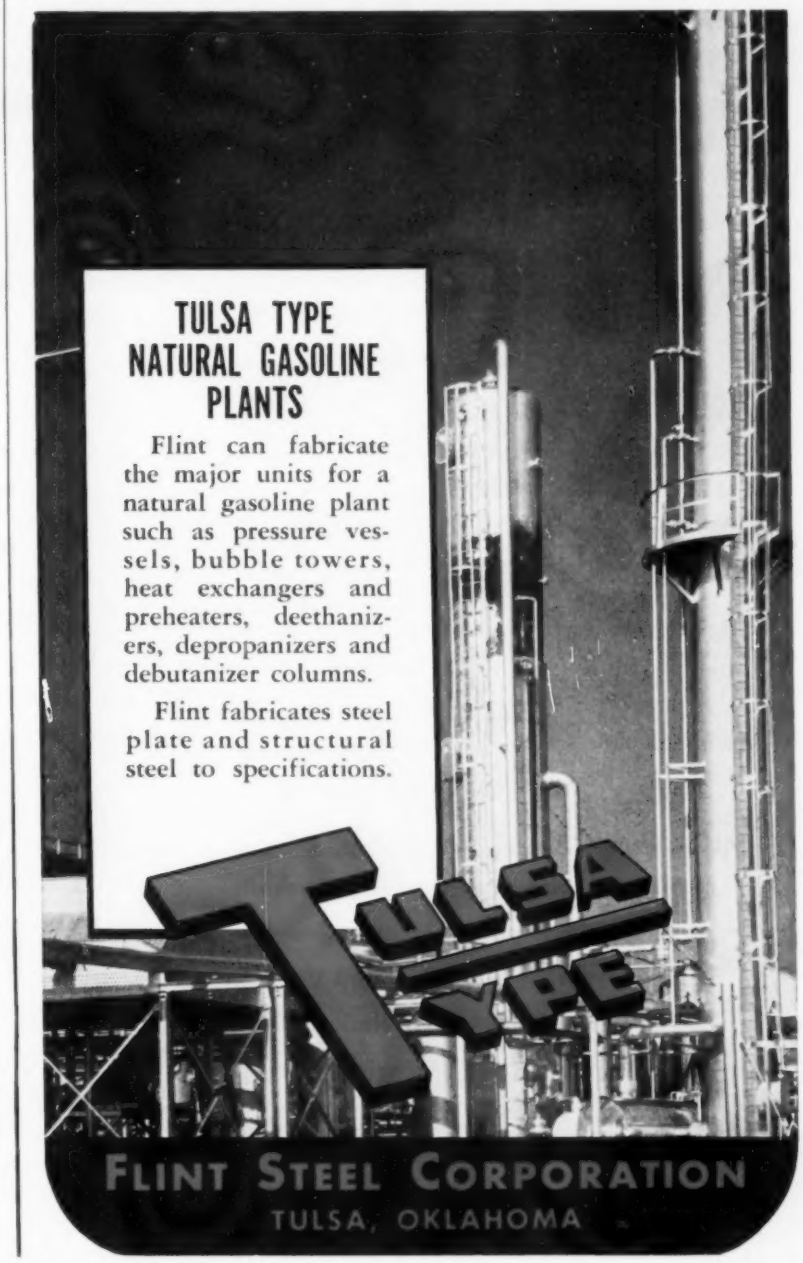
. . . in high pressure pipelines, a reprint of a paper dealing with problem of making branch connections to highly stressed transmission and distribution lines without interruption of fluid flow, *Bulletin* 533. Taylor Forge & Pipe Works, Chicago 90, Ill.

Circle No. **38** *on Reply Card*

Freon Compressors

. . . single-acting, multi-cylinder enclosed type; dimensions and data on company's new line, models JF and JS, 3 to 150 hp.; *Bulletin C-1100-B30C.* Worthington Corp., Harrison, N. J.

Circle No. **39** *on Reply Card*


TULSA TYPE
NATURAL GASOLINE PLANTS
Flint can fabricate the major units for a natural gasoline plant such as pressure vessels, bubble towers, heat exchangers and preheaters, deethanizers, depropanizers and debutanizer columns.
Flint fabricates steel plate and structural steel to specifications.
TULSA TYPE
FLINT STEEL CORPORATION
TULSA, OKLAHOMA

(To obtain more data on advertised products see page 424)

These Dollars Are Gone Forever!

Many, many companies in the petro-chemical field sign a blank check every year payable to The Korrosion Kids. And some of these companies never know what the corrosion of tube in heat exchangers and condensers is costing them.

But—here's a tip! You can save much of this money if you always use the *right* copper-base alloy condenser tube for the corrosive conditions you encounter. That way, you can be sure that your installation will stand up on the job.

Wolverine produces prime surface condenser tube in the following alloys: copper; Admiralty and inhibited Admiralty; cupro-nickle 70-30, 80-20, 90-10; aluminum brass; red brass 85%; and Muntz metal.

To help you pick the right alloy and to answer your questions relative to tubing, Wolverine has set up a Field Engineering Service. Call on them—*any time*. And to help you even more, Wolverine has just published a handy corrosion chart which tells you at a glance the action of various substances on copper and copper-base alloy tubing. You can have one—and a copy of our new condenser tube book—if you write today. No obligation, of course! Wolverine Tube Division of Calumet & Hecla, Inc., 1441 Central Ave., Detroit 9, Michigan.

Visit Wolverine Tube Division at Booth 20-21, 10th Annual National Association of Corrosion Engineers, Kansas City, Mo., March 15-19.

EST. 1916

WOLVERINE TUBE DIVISION
OF CALUMET & HECLA, INC.

Manufacturers of Quality-Controlled Tubing

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA • Sales Offices in Principal Cities

What's New!

Lube Oil Gelling Agent

. . . adapted to grease compounding, Bentone 34, is described in new booklet covering physical properties, how it is made, how it works, how it is used in grease manufacture, and other pertinent technical data. National Lead Co., Baroid Sales Div., P. O. Box 1675, Houston, Texas.

Circle No. **40** *on Reply Card*

Pipe and Fitting

. . . catalogue; stainless steel tangential fittings; complete data; also, data on all-purpose centrifugal pump; *Process Catalogue*. Process Pipe and Fittings Co., 6522 Upland St., Philadelphia 42, Pa.

Circle No. **41** *on Reply Card*

Plastic Pumps

. . . for handling corrosive fluids and abrasive slurries; illustrations, diagrams, operating specifications and performance data; *Bulletin — Flex-i-liner*. Vanton Pump & Equipment Corp., Empire State Bldg., New York City.

Circle No. **42** *on Reply Card*

CLASSIFIED

EMPLOYMENT • BUSINESS EQUIPMENT — USED OR RESALE OPPORTUNITIES

PROCESS EQUIPMENT LINES WANTED FOR SOUTHERN CALIFORNIA

Headq't'rs. Los Angeles—well established 13th year—this territory
Good volume now for present principals
Can add few good lines by well established M'f'r's. anxious for aggressive, capable, experienced
Engineering Sales Representation
Lines now:—Steam Jet Ejectors, Steam Vacuum Refrig., Surface and Barometric Condensers, Bag type Dust Filters Fire Tube Boilers.

Good Will with Oil Refiners, Chem. Plants, Food Proc., Cons. Eng'r's. & Contractors result good engineering.

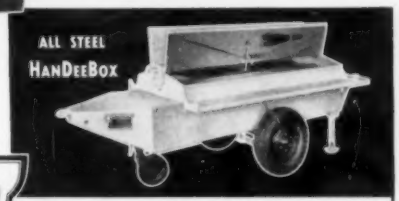
Good Service & Good Sales Effort.

Owner will stop in Chicago, Detroit, Cleveland, and New York, late April or early May for discussions.

Reply
RW 1787 Petroleum Processing
1111 Wilshire Blvd., Los Ang. 17, Cal.

REFINERY MAINTENANCE CREWS DEPEND ON LITTLEFORD ALL STEEL PORTABLE TOOL BOXES

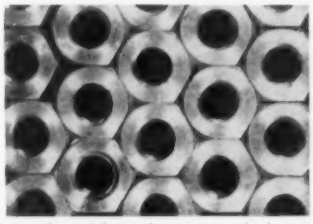
Model 55 All Steel Tool Box is the maintenance crew helper. It is used for transportation and storage of tools, one tool box can be used for each pipe tapping machine and its accessories. When tools are needed this fast trailing Model 55 Tool Box is ready to go—no delays. Tools do not have to be checked in or out everyday, they're assigned to the maintenance crew and they use them continuously. By using a towing hitch three or four Tool Boxes can be transported at one time. These Model 55 All Steel Tool Boxes are saving Refineries thousands of dollars. Modernize your maintenance crews with this fireproof—thiefproof Tool Box—it's a low cost investment.



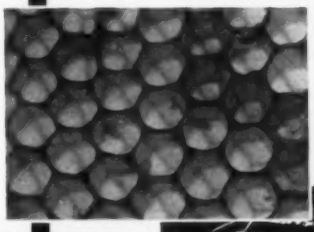
Here's the 8 ft. Weatherproof, Thiefproof and Fireproof All Steel Tool Box for transporting valuable tools or for leaving tools on the job over night. It's a low cost labor saver for maintenance crews.

LITTLEFORD
LITTLEFORD BROS., INC.
448 E. Pearl St., Cincinnati 2, Ohio

SIX SIDED SYMBOLS of fabricated strength



Honeycomb and brass hex nut . . both are fabricated for strength and special purpose.



St. Mary fabricating engineers, like those in nature, build strong industrial structures for special purposes. For tanks, pressure vessels or steel buildings, the following industries know St. Mary Iron Works well:

RICE SUGAR TUNG SALT FISH SULPHUR
PETROCHEMICALS WATER TRANSPORTATION

For special or general purpose steel fabrication, consult St. Mary engineers today.

—WANTED—TECHNICAL WRITER—

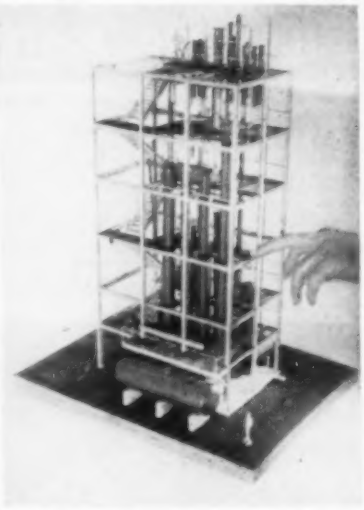
We need a technically-trained man, under 30, for the editorial staff of PETROLEUM PROCESSING. He should have a background of mechanical engineering and experience in refining or petrochemical manufacturing operations—with emphasis on equipment. He should be able to write clearly and cleanly, and have done some work in preparing reports.

He should have an inquisitive mind and like to probe into the "why" of things, and be able to explain to others what he has found out.

Experience in magazine or newspaper production is desirable but not essential.

Duties will include editing and rewriting copy, with responsibility for specific departments in the magazine, and field trips to gather data for original articles. Location is in New York City, and salary is open. Send details to:

EDITOR, PETROLEUM PROCESSING
330 West 42nd Street • New York 36, New York

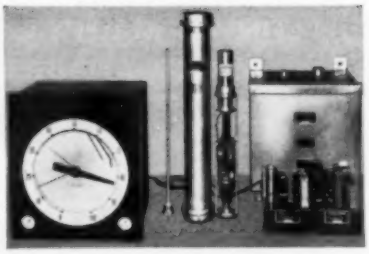


Savings on scale models are frequently 10 to 30 times their cost. Savings are made in design, construction, sub-contracting, and operator training. In addition; better, safer design is obtained resulting in lower operating and maintenance costs, and earlier plant start-up.

We build about 100 models/year of process plants and oil refineries representing some $400,000,000 of new construction. Our engineers can build the model *ahead of* the blueprints, working in your design office.

INDUSTRIAL MODELS, INC.

2311 Sconset Rd. Wilmington 3, Del.
1220 W. 6th St. Cleveland 13, Ohio
67 Fulton St. New York 7, N. Y.
827 Moraga Drive Los Angeles 49, Cal.



GAGETRON*

*Patent No. 2,565,963
Other patents pending.

LEVEL CONTROL via gamma rays

this instrument specifically designed for the gauging of liquid or catalyst levels.

It may be applied to give continuous level record or control levels at some pre-determined point.

GAGETRON'S OPERATION UNIQUE

Since the gamma rays will penetrate steel vessel walls —much as hard X-rays—it eliminates the necessity of tapping the vessel wall as is normally required when using conventional measuring mechanisms.

The Gagetron operates on a principle of a receiver (Geiger Tube) being triggered by gamma rays which are liberated from a source of radium or Cobalt 60. This source, or sources, as may be required, may be located either internal or external to the vessel wall near the point or range over which control is desired.

The receiver (Pre-amplifier) is mounted outside the vessel and above the level range to be measured or controlled.

For information, write ELECTRONICS DIVISION

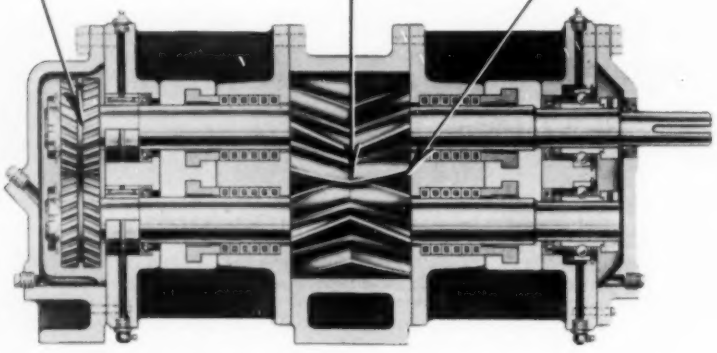
INSTRUMENTS, INC.
122 N. Madison Tulsa 6, Okla.

GEAR PUMP MAINTAINS EFFICIENCY HANDLING CORROSIVE LIQUIDS

Precision-cut external timing gears maintain proper rotor clearance

No metallic contact between rotors or rotors and casing

Wetted parts made of any machineable corrosion-resistant material



Sier-Bath
External Gear and Bearing
"GEAREX" PUMPS

32 SSU to 1,000,000 SSU; 1-550 GPM; 250 PSI for viscous liquids, 50 PSI for water. Direct-connected up to 1800 RPM. Horizontal or vertical construction. Jacketed bodies available. *Sier-Bath Gear & Pump Co., Inc., 9261 Hudson Blvd., North Bergen, N. J.*

Call Your Sier-Bath Pump Representative ... Send for Bulletin G-2.

Founded 1905 Member A.G.M.A.

Sier-Bath Screw, "Gearex" and "Hydrex" Pumps ... also manufacturers of Precision Gears and Flexible Gear Couplings

What's New!

Flexible Tubing

. . . for many uses; steel, bronze, and aluminum tubing and hose in many types of construction; complete engineering data on all "Penflex" tubing and couplings; 8-page booklet, *"Penflex Flexineering."* Penflex, 72nd St. & Powers Lane, Philadelphia, Pa.

Circle No. **43** *on Reply Card*

Combination Processing

. . . and how it can cut more than 20% from investment costs in building today's refineries is fully described in *Kelloggram* No. 1, 1954; with details on costs and an analysis of potential savings tabulated for representative refineries using conventional as well as the combination processing schemes. M. W. Kellogg Co., Refinery Process Div., 225 Broadway, New York 7, N. Y.

Circle No. **44** *on Reply Card*

Dehydrogenation Process

. . . in this review of basic principles and discussion of improvements from almost 10 years of commercial and semi-commercial experience; December, 1953, issue of *Houdry Pioneer*, including table showing economics of butane dehydrogenation. Houdry Process Corp., 1528 Walnut St., Philadelphia 2, Pa.

Circle No. **45** *on Reply Card*

Did You Miss These?

The following items, reviewed originally in December, 1953, have aroused considerable interest among the readers. They are repeated briefly here as a service to those who might have missed them the first time. For details or literature, use the regular Reply Card in this issue.

Adhesive Developed for Binding Teflon to Itself or to Metal

. . . and a variety of other materials. Of the pressure-sensitive type, the new adhesive is said to have good acid and alkali resistance and electrical properties. Tests have indicated a peel strength of over 1000 gm./inch, or a direct pull of 12 to 15 psi. for Teflon to Teflon and Teflon to stainless steel. The material, "Flexrock No. 80," can be applied by brushing, dipping, or spraying. For small applications, brushing is reported to be adequate. Air drying is satisfactory but takes several hours, and this period can be re-

duced by heating for 15 to 30 minutes at about 210° F. Heating for five minutes at 300° F. will result in greater adhesive strength. Flexrock Co., Packing Division, 3602-T Filbert St., Philadelphia 1, Penna.

Circle No. **46** *on Reply Card*

Water Treating

. . . by demineralizing; 39-page *Bulletin* 5800 explains the principles of ion exchange and outlines design and operation of multi-stage and mixed bed demineralizing systems, with operating results and flow diagrams of several existing plants. Cochrane Corp., Philadelphia 32, Penna.

Circle No. **47** *on Reply Card*

Pipe Thread Sealing Compound Prevents Spiral Wicking

. . . and leakage. "T-Film" is chemically inert, having a base of du Pont Teflon, and is said to be suitable for metallic and plastic threaded connections in all types of process pipe lines and apparatus. Because of the base material's non-adhesive characteristics, the compound is said to give a leakproof joint which is easily broken when necessary without galling or sheared threads. Two consistencies are offered, a light-bodied variety for precision threads, and a viscous consistency for manual application. Both are said to be suitable for all chemicals to which the base product is inert, and for temperatures up to 400° F. Eco Engineering Co., 12 New York Ave., Newark, N. J.

Circle No. **48** *on Reply Card*

Tank Car Classifications

. . . for ladings; 34-page brochure illustrating in detail manufacturers' new improvements in design, giving tabulated information on just what type of tank car is needed to carry specific chemical compounds. American Car and Foundry Co., 30 Church St., New York 8, N. Y.

Circle No. **49** *on Reply Card*

Synthetic Cracking Catalyst

. . . test methods; 48-page booklet describing a group of standardized testing procedures for measuring important properties of silica-alumina synthetic cracking catalyst, including determination of apparent bulk density, activity, steam stability, thermal stability, particle size distribution, and others. American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.

Circle No. **50** *on Reply Card*

For Your Convenience

Business reply cards are included in each issue of Petroleum Processing to assist you in obtaining more information on any items reviewed in "What's New!" You'll find them facing the first page of this section. Just circle the numbers corresponding to the numbers at the end of each item. Then fill in the rest of the card and drop it in the mail. No postage is required.

A copy of this quick-reading, 8-page booklet is yours for the asking. It contains many facts on the benefits derived from your business paper and tips on how to read more profitably. Write for the "WHY and HOW booklet."

McGraw-Hill Publishing Company, Room 2710, 330 West 42nd St., New York 36, N.Y.

(their escape means continuous added costs and annoyance to your neighbors)

MMC CATALYST FILTERS

replace cyclones and electrostatic precipitators and offer

- complete catalyst retention
- low pressure drop
- hi-temp service
- low maintenance cost

Write for literature requesting Bulletin 31C

Another engineered filtration service using porous stainless steel by

MICRO METALLIC CORPORATION

33-L SEA CLIFF AVE. GLEN COVE, N. Y.

PALL

The Pall Filtration Companies

Micro Metallic Corporation | Porous Plastic Filter Company | Aircraft Porous Media, Inc.

FOR YOUR ALLOY PIPING SYSTEM

there's a KEY-KAST FLANGE

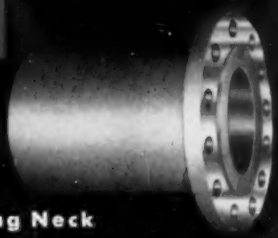
Welding Neck

in every
TYPE
SHAPE
SIZE
SCHEDULE

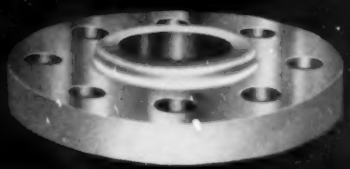
Engineered for Longer Life

- Controlled quality . . . through rigid metallurgical control
- A.S.M.E., A.S.T.M. and A.S.A. Code
- Lower unit cost . . . plus prompt deliveries
- Machined surface

Write for prices and literature



Long Neck



Slip-On

Screwed

key company

Since 1916 . . . manufacturers and developers of products for high temperatures and pressures

P. O. BOX 494-E EAST ST. LOUIS, ILLINOIS

DISTRICT OFFICES: NEW YORK • CLEVELAND
CHICAGO • TULSA • HOUSTON • LOS ANGELES

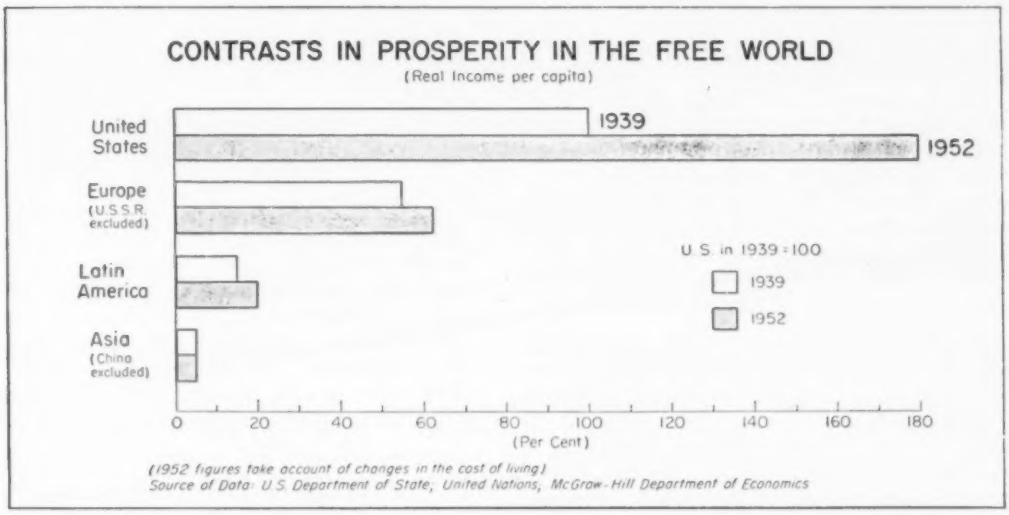
Contrasts in Prosperity Endanger the Free World

The chart in the middle of this page summarizes a situation of profound importance to every American. It shows that:

1. On the average, Americans are vastly better off economically than most other people in the free world, and
2. In recent years the gap in income between the average American and the average European, Latin American or Asian has greatly widened.

A Mounting Contrast

Even greater is the contrast between the real incomes of Asians and Americans. Today most Asians are no better off economically than they were back in 1939. On the other hand, the real income of the average American has almost doubled. As a result, the real income of the average Asian—always small by our standards—is now only a tiny fraction of that of Americans.



The chart shows that, at the outbreak of World War II, the real income (that is, actual purchasing power of income) of the average American was substantially higher than the average European's and much higher than the average Latin American's or Asian's. Since then, the European and Latin American have become better off. But the improvement in the economic lot of the average American has been so great that the others have been left far, far behind.

It must be remembered that the figures used to construct the chart are of varying quality. The fact is that few of the poorer countries have reliable statistics. However, it is generally agreed among competent observers, that the figures here presented offer a correct impression of the wide disparity in the average of real incomes between various parts of the free world. The figures, of course, have nothing decisive to say about spiritual and cultural values. In these, coun-

tries with relatively little material prosperity may be rich.

It is possible to draw a variety of morals from the story of lagging growth of income in other parts of the world. For one thing, it reflects the dynamic force of private enterprise. Private enterprise is characteristic of our economy far more than it is of most of the other free economies. The chart also reflects the fact that we are bountifully blessed with the natural resources essential to a high level of real income. Moreover, we did not suffer from the devastation and waste of two world wars as did many of the other free nations.

Narrowing the Gap

But perhaps the most important message which the chart conveys is one of warning. It warns that something must be done to narrow the gap in prosperity between America and other parts of the free world, if that world is to be united successfully in the struggle against totalitarian Communism. Writing in the HARVARD BUSINESS REVIEW, Kenneth E. Boulding recently put it this way:

> *"The crux of the problem is how to raise the three-quarters of the world that live on a low level to the high level of the other quarter, for it is precisely this wide disparity that makes our world so unstable. American-Russian relations, for instance [are] . . . complicated almost unbearably by the fact that each power is competing for the support of the vast fringe of underdeveloped countries . . . These countries are dissatisfied with their present state and are hovering between the two cultures, wondering which offers them the best chance of shifting from their present low-level to a high-level economy."*

Very real danger threatens from any feeling which may develop in the less fortunate free nations that our enviable economic progress has been made at their expense. Instead of viewing the American economic system as a model that might be followed by their own countries, they may be led to see in it a menace to their well-being. If Communist propaganda can persuade these people that their alliance with the free world will only result in their dropping farther and farther behind an increasingly prosperous United States, they will be driven to the side of totalitarianism.

Test of Effective Leadership

How can these free nations on the lower half of the income ladder be helped to alleviate the conditions that keep them there? Surely this question poses a whole series of complicated problems. Yet, if we do not exercise some effective leadership toward their solution, we can be sure that Russia will take advantage of the situation. In these circumstances, it is essential to both the stability and security of the free world that we help our less prosperous neighbors make satisfactory headway.

This does *not* mean that the United States should sacrifice its own economic progress in favor of some sort of global leveling scheme. On the contrary, a continually expanding and stronger economy is essential if we are to provide any real aid to our friends. Also, it goes without saying that our friends must be disposed to do all they can to improve their own economic position, if our cooperation to that end is to be effective.

Great Skill Required

Our part in a program to achieve this goal calls for a high degree of skill and statecraft. It involves international trade policy, which, in itself, presents a perplexing range of problems. It involves also programs of foreign technical and economic assistance. And expanded foreign investment must play a key role in a balanced program to strengthen the economies of the free world for our common good.

The Commission on Foreign Economic Policy, headed by Clarence Randall, has recently submitted a report, embodying the results of a monumental inquiry into our foreign economic relations and measures to improve them. From the very nature of the subject, discussion of the report is bound to be attended by much controversy and conflict. However, an awareness of the facts presented by this chart should inspire us to accord to the problems posed by the Randall Commission the careful and sober consideration they must have if any real progress is to be made in raising the general standards of human well-being throughout the free world. Our willingness and ability to do this have now become the real test of our statesmanship, both at home and abroad.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

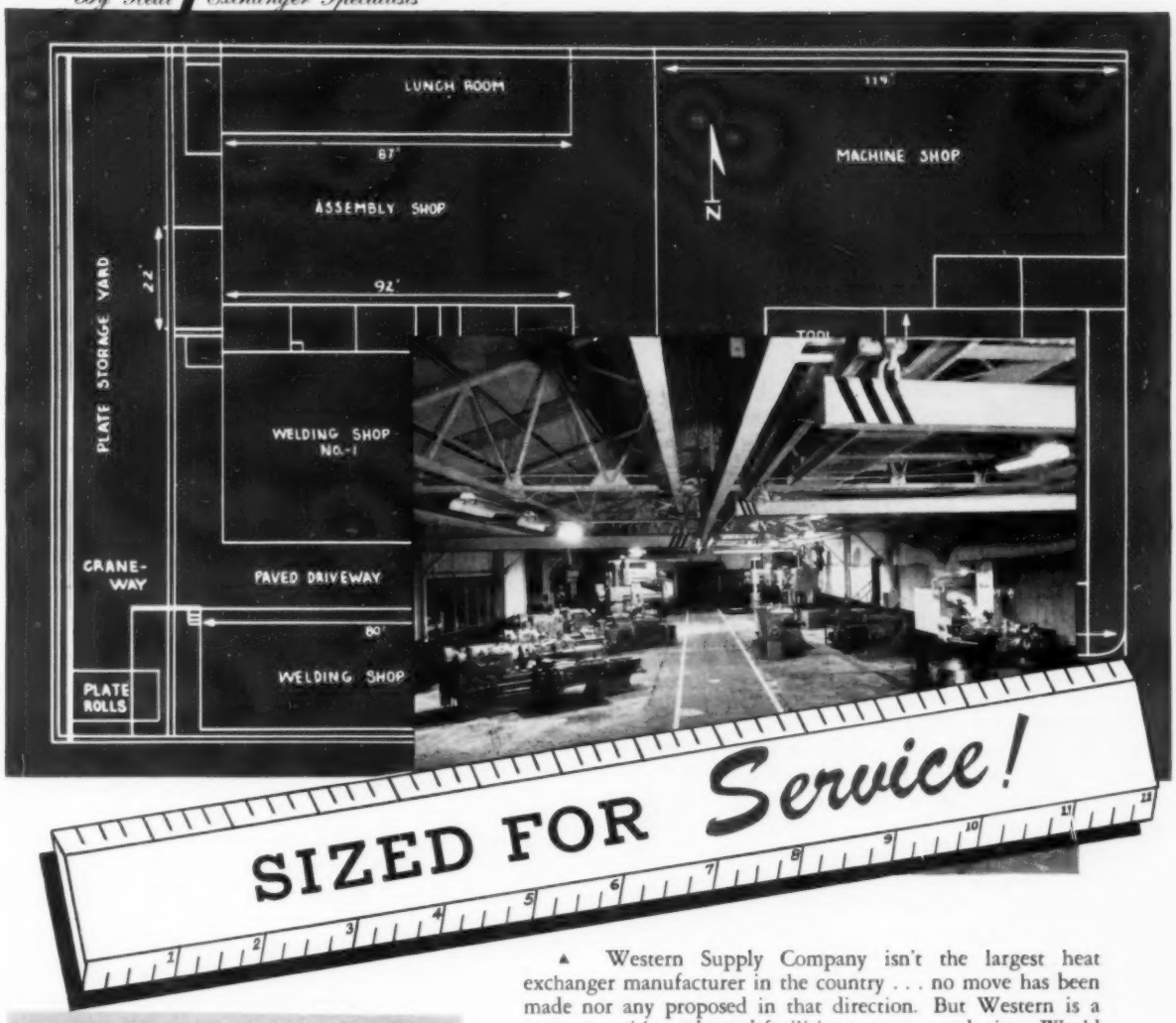
Donald C. McGraw

PRESIDENT

McGraw-Hill Publishing Company, Inc.

By Heat Exchanger Specialists

▲SYNOPSIS OF AD #1: Western Supply Company of Tulsa, Oklahoma, started as a small machine shop in 1906. The growth of the Southwestern oil country supported the small operation, and in 1936 Western began building heat exchangers for the pipeline industry. This specialized fabrication soon expanded to encompass the refining, chemical and petrochemical fields.



PROOF OF FLEXIBLE SERVICE . . . On October 29th of this year a prominent chemical company filed an emergency order for an Amine Reboiler. This unit was engineered, fabricated and delivered by November 15, just 17 days following the customer's desperate phone call. Naturally such short-term delivery is not a general rule, but is an excellent example of the speed which can be achieved when a company is not overwhelmed by its own bulk.

▲ Western Supply Company isn't the largest heat exchanger manufacturer in the country . . . no move has been made nor any proposed in that direction. But Western is a company with a *planned* facilities program, and, since World War II, the addition of the latest mills, lathes, rolling, bending and welding equipment have earned it the reputation of one of the most modernly equipped heat exchanger plants in the United States.

Because of its moderate size and the degree of control it exercises over the heat exchangers it is to build, the plant is truly "sized for service" and offers its customers a flexibility and speed invaluable on emergency or deadline fabrication. Working in both common and alloy metals, Western designs and manufactures for the high pressures and temperatures of today's processing requirements.

2nd in a new series of advertisements

WESTERN HEAT EXCHANGERS

WESTERN SUPPLY CO.

P. O. BOX 1888 • TULSA, OKLAHOMA

(To obtain more data on advertised products see page 424)

EDITORIALS . . .

"Big Union" Threat Can Give Oil Industry a Black Eye

LAST month a group of delegates from 26 independent and four AFL oil industry unions met with representatives of CIO's Oil Workers International Union in Philadelphia to discuss a merger. The details of that meeting and what took place are described at length in the article "And Now—A 'Big Union' in Oil" on pg. 349 of this issue.

Briefly, the group approved a proposed constitution for a new Oil and Chemical Workers International Union, and set a target date of Aug. 23 for its ratification by the various unions concerned.

Jack Knight, president of OWIU, has long been plugging for such a coalition—or grouping of forces. For a number of years he has been loudly and directly promoting the merger. Every attempt failed, however; the independent unions have always refused to go along. Since the direct approach hasn't been fruitful, Mr. Knight is now attacking from a different angle with more chance for success.

The Philadelphia meeting was supposedly spontaneous—called by the heads of certain independent unions as a result of "popular demands" by their rank and file members. Mr. Knight and his OWIU were ostensibly not responsible for the show—either for planning it or for running it.

Yet the plan for the "call" of the independent unions was developed in New York last December during a meeting of Mr. Knight's National Coalition of Oil Workers Unions.

And Mr. Knight, while appearing to sit on the sidelines at Philadelphia, did manage to send a 35-member delegation there to represent OWIU, and made his publicity man available to help with the dissemination of such information as should be released.

Right now it's impossible to tell whether a gigantic Oil and Chemical Workers International Union will come into existence as a result of the Philadelphia meeting.

We think the independent unions would be making a sad mistake if they fell into Mr. Knight's trap. Most of their members enjoy far better fringe benefits with respect to vacation, insurance, sick leave, retirement and the like than do their brothers under the OWIU banner.

They have secured these benefits at far less cost to themselves (refinery workers lost over $20,000,000 in wages during OWIU's 1952 strike) and to the nation (that same strike cost the country 50,000,000 bbls. of products).

They have far greater control over their union dues, activities and officers than they would if policies were dictated by Mr. Knight and his staff in Denver.

Aside from the disadvantages we see for the independent unions' members, such a merger holds a very serious threat for the oil industry itself. OWIU at present is able to shut down by strike action about 35% of the country's refining capacity. If all the unions attending the Philadelphia meeting join up, the new union would be able to put more than 50% of the refining capacity out of service—and even more as Mr. Knight realizes his ambition of gobbling up additional independents.

Oil can't afford to get the black eye coal has achieved by letting a monopoly labor group get a strangle hold on its ability to meet consumer needs.

The Issue of FPC Authority

THE latest development involving the jurisdiction of the Federal Power Commission over the natural gas producing industry is typical of the confusion as to just what the powers of this government agency are under the Natural Gas Act of 1938.

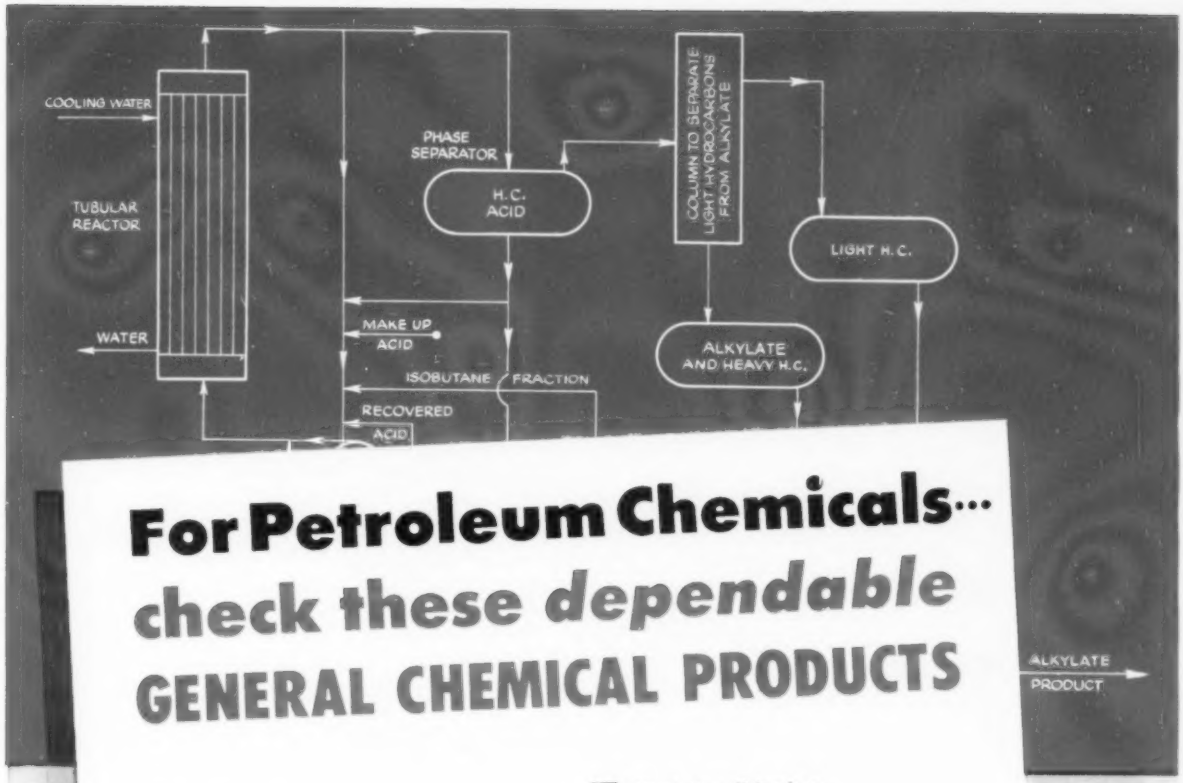
The U. S. Supreme Court on Jan. 18 reversed its earlier position and announced it would review a lower court ruling in a case involving gas rates. The lower court had held that FPC was required to set rates at which Phillips Petroleum Co. should sell gas to an interstate pipeline, despite Phillips showing that its operations were as a producer and gatherer of natural gas. The FPC itself had earlier announced its lack of jurisdiction in rate transactions at the wellhead. The high court first said it would not review the Phillips case; then it said it would.

Whether or not the Supreme Court's ruling will clarify the authority of FPC under the natural gas act depends on how broad a study it makes of the Phillips case. If it goes fully into the Commission's rate making powers, the Court may decide on the extent of the supervisory authority over natural gas producing and allied operations which the Commission at times has claimed, if not actually used.

For example, the question of the authority of FPC over gas processing operations still remains unsettled. A few years ago the Commission made some gestures towards supervision, and possibly regulation, of natural gasoline and cycling plants as a necessary corollary to setting gas rates. With the great growth of petrochemical plants using natural gas as a raw material, these points need authoritative clarification.

The Supreme Court's ruling in the Phillips case, if broad enough, could take the place of legislation by Congress to define the authority of the Federal Power Commission under the Natural Gas Act. The oil and gas industries tried unsuccessfully to secure such a law through the Kerr bill, which was passed by Congress in 1952 but vetoed by Truman.

If the high court's decision does not settle the issue, the two industries will have to be prepared to again bring the matter before Congress. It cannot be left to FPC to set up its own rules for operation under the gas act.



For Petroleum Chemicals... check these *dependable* GENERAL CHEMICAL PRODUCTS

☐ *Alkylation*
ANHYDROUS HYDROFLUORIC ACID
SULFURIC ACID

☐ *Polymerization*
FLUOSULFONIC ACID $HO{:}SO_2F$ (HSO_3F)
BORON TRIFLUORIDE
SULFURIC ACID

☐ *Sulfonation*
SULFURIC ACID
SULFAN® (Stabilized Sulfuric Anhydride)
OLEUM

☐ *Isomerization*
MURIATIC ACID (Hydrochloric)

☐ *Detergents & Builders*
SODIUM METASILICATE
DISODIUM PHOSPHATE
SODIUM SULFATE, Anhydrous
TRISODIUM PHOSPHATE
TETRASODIUM PYROPHOSPHATE (TSPP)
SODIUM TRIPOLYPHOSPHATE

☐ *Acidizing*
MURIATIC ACID (Hydrochloric)
HYDROFLUORIC ACID

☐ *Mud Conditioning*
SODIUM SILICATE
DISODIUM PHOSPHATE
TRISODIUM PHOSPHATE
TETRASODIUM PYROPHOSPHATE (TSPP)
SODIUM TRIPOLYPHOSPHATE

☐ *Grease Making*
ALUMINUM SULFATE

☐ *Acid Treating*
SULFURIC ACID
SODIUM SILICATE

☐ *Other Chemicals*
Aluminum Sulfate, Standard & Iron Free
Aqua Ammonia
Cuprous Chloride
Nitric Acid
Potassium Nitrite
Sodium Fluoride
Other Heavy Chemicals

☐ *Catalysts and Special Chemicals*
Companies requiring catalysts, addition agents, inhibitors, or other special chemicals "tailor-made" for their individual processes, are invited to consult with General Chemical on their requirements.

For the Laboratory or Special Applications: Baker & Adamson Reagents and Fine Chemicals

GENERAL CHEMICAL DIVISION

ALLIED CHEMICAL & DYE CORPORATION

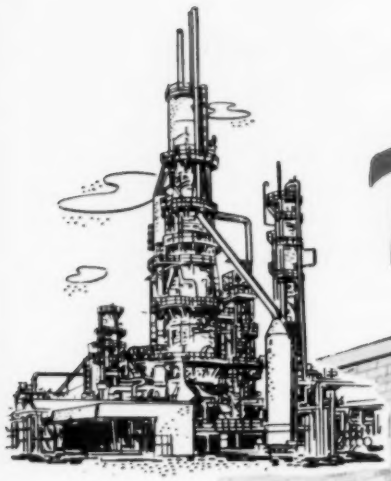
40 Rector Street, New York 6, N. Y.

Offices: Albany • Atlanta • Baltimore • Birmingham • Boston • Bridgeport • Buffalo • Charlotte • Chicago • Cleveland • Denver • Detroit • Greenville (Miss.) • Houston • Jacksonville • Kalamazoo • Los Angeles • Minneapolis • New York • Philadelphia • Pittsburgh • Providence • San Francisco • Seattle • St. Louis • Yakima (Wash.)
In Wisconsin: General Chemical Company, Inc., Milwaukee

In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver

Basic Chemicals for American Industry

Allied Chemical



Point of Return...

It is WYATT'S policy to fulfill each assignment to such satisfaction that the customer will by preference return to the Wyatt threshold with each recurring need in metal fabrication.

Wyatt's
HOUSTON · DALLAS · NEW YORK · TULSA

MANUFACTURERS AND ERECTORS SINCE 1913